S. HRG. 98-747

LANDSAT COMMERCIALIZATION

HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, TECHNOLOGY, AND SPACE

OF THE

COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

SECOND SESSION

ON

S. 1855

TO AUTHORIZE THE OPERATION OF UNITED STATES LAND REMOTE SENSING SATELLITE SYSTEMS, AND FOR OTHER PURPOSES

S. 1861

TO AUTHORIZE THE DEVELOPMENT OF A NEW GENERATION LAND REMOTE SENSING SATELLITE, AND TO ENSURE THE ROLE OF THE UNITED STATES AS THE WORLD LEADER IN DEVELOPING AND UTILIZING LAND REMOTE SENSING TECHNOLOGY THROUGH THE LANDSAT PROGRAM

S. 2292

TO PROVIDE FOR CONTINUED ACCESS BY THE FEDERAL GOVERNMENT TO LAND REMOTE SENSING DATA FROM SATELLITES, AND FOR OTHER PURPOSES

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LANDSAT COMMERCIALIZATION

THURSDAY, MARCH 22, 1984

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m. in room SR-253, Russell Senate Office Building, Hon. Slade Gorton (chairman of the subcommittee) presiding.

Staff members assigned to this hearing: Charlie Faust, professional staff member; and Marty Kress, minority professional staff member.

OPENING STATEMENT BY SENATOR GORTON

Senator GORTON. Good morning, and welcome to this hearing before the Science, Technology and Space Subcommittee of the Senate Commerce Committee.

We are here this morning to consider the issue of land remote sensing satellite commercialization. The Landsat issue has been before the committee since March 1983 when the President announced his intention to transfer both the Landsat and meterological satellite—or Metsat—systems to the private sector.

My feeling at that time, which I think was shared by many of my colleagues, was that the Landsat transfer was an interesting proposition, worthy of consideration, but that commercializing the weather satellites simply did not make sense. Since commercialization of the Landsat and Metsat systems were proposed as a package, I felt that we had to reject the idea of Metsat commercialization before we could objectively consider Landsat commercialization.

For this reason, I introduced a resolution calling on the administration to drop Metsat from the proposal. Thanks to the support and further efforts of my colleagues, Metsat was dropped from consideration last fall.

The time we lost while considering the Metsat issue has made the need for a decision on the future of Landsat especially critical. With Landsat 5 expected to function only until 1987, we must act immediately to avoid a large data gap after it stops functioning. Any break in data continuity would inhibit the development of markets for data and provide a major competitive advantage to foreign remote sensing systems.

The delay caused by debate over whether our future capabilities should be public or private cannot be permitted to leave us without any U.S. capability at all.

My colleagues, Senators Pressler and Hollings, and I have all introduced bills designed to set a future course for U.S. land remote sensing. Although we have proposed different solutions to this problem, I am certain that we all agree that reaching a decision as quickly as possible is critically important.

Today, we will hear testimony from many witnesses, including representatives of the Federal Government, private industry, and users of remote sensing data products. I hope that the witnesses will provide us not only with their views of the commercialization process in general, but also with specific recommendations as to how legislation should guide the process.

Before we begin, I would like to clarify a point that has been raised about my bill, S. 2292. There is a provision regarding the types of data to be generated by a followon system to Landsat. The bill states that one of the criteria the Secretary of Commerce must use in evaluating commercialization proposals is how the data for a private system compare with qualities and quantities of data used by the Federal Government in fiscal year 1983.

Questions have been raised as to whether this provision is intended to specify the thematic mapper as a system requirement, since thematic mapper data was available in 1983.

I wish to clarify that I do not intend to set any such requirement. I only want to specify that I consider the types of data to be produced by a private system to be an important factor in evaluating commercialization proposals.

To make this clear, I propose to change the language to say simply that the Secretary must consider the types of data to be generated by the system as part of the evaluation of proposals.

I also wish to emphasize that the types of data to be provided is only one of a number of criteria the Secretary must review. I think that any legislation in this area should define all important evaluation factors, and should not dictate the acceptable content of proposals. I am willing to change the language to clarify that intention.

Since we do have a large number of witnesses today, we must ask that all statements be kept as brief as possible. We have reviewed the written statements, and they will be entered into the hearing record in their entirety.

Senator Hollings has an opening statement which will be placed in the record.

[The statement and bills follow:]

OPENING STATEMENT BY SENATOR HOLLINGS

Mr. Chairman, the members of this subcommittee are well aware of the fact that this Nation is seeing the dawn of a new era in space technology. It is a time of increasing commercialization—of greater private sector involvement and competition. And during this period we will most certainly see many incredible and wondrous advancements in the way we gather, process, and use information from earth-orbiting satellites. Not only will the technological progress be significant, but its impact on the everyday lives of millions of people throughout the world will grow by leaps and bounds.

Space commercialization will bring great improvements to our society. We've already seen this happen in the area of satellite communications. And it's sure to happen again as we commercialize the Federal government's land remote sensing satellite (or Landsat) system over the next few years. Although the Landsat program has been a technological success under government control, the lack of a long-range plan to convert it into a user-sensitive, operational system has suppressed the data market. Clearly, commercialization of Landsat will open up the market and bring about tremendous economic and public benefits.

However, we are not, I believe, so taken up with the endless possibilities of space commercialization as to ignore the question of continued Federal involvement. Indeed, this is the purpose of today's hearing: to assess what the Federal role will be during and after the commercialization of the Landsat system. Certainly we want to bring about all the benefits of a free market and encourage a climate for innovation, imagination, and the entrepreneurial spirit so characteristic of this nation. Both there are other very important concerns—national security, international relations, preservation of a competitive enviroment, and (most importantly) the public interest.

It is up to this subcommittee, and ultimately the entire Congress, to determine the conditions that should be imposed on the transfer of the Landsat system to the private sector. I, for one, have some very specific questions. For instance: What will be the impact of Landsat commercialization on Federal and non-Federal data users? Will data continuity be assured? What about the impact on international relations? Will international competition in land remote sensing affect the transfer? And how will the "open skies" policy, which has allowed all nations to acquire data under equal terms, be affected?

These questions are not necessarily addressed in the free market. While there exists no serious opposition to the commercialization of Landsat, it is only proper that these concerns be addressed by the Congress.

We have before us three bills to consider. Each one proposes certain minimum conditions on the transfer of the Landsat system to the private sector, and each establishes a government role in assuring the continued viability of the system. It is important that this subcommittee adopt legislation during this session to keep the Congress involved in this very important aspect of space technology development and to facilitate the commercialization of Landsat.

The commercialization of space is truly one of the premier issues of this decade—perhaps of our entire generation. Mankind stands to benefit a great deal from the gains we make in this area. But it must be handled properly. The issue is far too important to our society and the societies of future generations to just cast our seeds to the winds of private enterprise and hope for the best.

98TH CONGRESS
1ST SESSION

S. 1855

To authorize the operation of United States land remote sensing satellite systems, and for other purposes.

IN THE SENATE OF THE UNITED STATES

SEPTEMBER 20 (legislative day, SEPTEMBER 19), 1983

Mr. HOLLINGS (for himself, Mr. FORD, and Mr. RIEGLE) introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

---

A BILL

To authorize the operation of United States land remote sensing satellite systems, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Land Remote Sensing Satellite Authorization Act of 1983".

FINDINGS, PURPOSES, AND POLICY

SEC. 2. (a) FINDINGS.—The Congress finds and declares that—

(1) remote sensing from satellites can assist the rational management of the Earth's natural resources and environment by providing data on the geological,

biological, hydrological, agricultural, and other natural features of the Earth's surface;

(2) the United States is the world leader in developing land remote sensing technology through the experimental Landsat program;

(3) remote sensing data from satellites has been valuable and useful and is expected to be in greater demand in the future if it is available on a continuous, timely, and reliable basis, since data continuity is essential to market development;

(4) the Federal Government should, for the near future, continue to be responsible for the existing United States land remote sensing satellite system (including Landsats D and D), so that the market for data and data products from such a system will expand and become more mature;

(5) the private sector has the technical ability and financial resources to develop, own, and operate future United States land remote sensing satellite systems and, therefore, authority for private sector involvement in land remote sensing should be provided;

(6) the rapid development of follow-on land remote sensing satellite systems by the private sector should be encouraged to preserve and enlarge the

benefits already realized from the existing United States land remote sensing satellite system; and

(7) the ownership and maintenance of the United States meteorological satellites are the responsibilities of the Federal Government and no action should be taken to transfer, lease, or sell them to the private sector.

(b) Purposes.—It is declared to be the purposes of the Congress in this Act that—

(1) the Secretary of Commerce shall be responsible for the operation of the existing United States land remote sensing satellite system (including Landsats D and D), with authority to lease or contract such operation to the private sector;

(2) the Secretary of Commerce shall establish a process for assuring data continuity after the existing United States land remote sensing satellite system is no longer in operation; and

(3) any United States land remote sensing satellite system shall be operated in a manner consistent with the national security and international obligations of the United States.

(c) Policy.—It is declared to be the policy of the Congress in this Act that—

(1) the United States should take steps to ensure, on a nondiscriminatory basis, dissemination of data from any United States land remote sensing satellite system;

(2) all nations have the right to acquire data from space systems in outer space;

(3) space technology developed by programs of the United States Government should be transferred to the private sector whenever feasible and cost effective; and

(4) any regulations required under this Act shall be designed to encourage private sector operation of, and competition among, land remote sensing satellite systems.

DEFINITIONS

SEC. 3. As used in this Act, unless the context otherwise requires, the term—

(1) "data" means a set of signals collected by sensors on a satellite that are useful in describing or viewing the Earth's resources, features, or environment, but does not include conclusions, manipulations, or calculations derived from such measurements and observations;

(2) "data-handling segment" means that portion of the United States land remote sensing satellite

system that receives, processes, stores, and manages data transmitted from a satellite, including the aggregation or processing of such data into usable information, except that such term does not include the space segment, as defined in paragraph (3) of this section;

(3) "space segment" means that portion of the United States land remote sensing satellite system associated with satellite operation and control, and includes the satellite, its sensors, and associated equipment and facilities for tracking, guidance, and command purposes, except that such term does not include the data-handling segment, as defined in paragraph (2) of this section;

(4) "land remote sensing satellite system" means a system of one or more satellites operating in outer space, the purpose of which is to obtain data on the geological, biological, hydrological, agricultural, and other natural features of the Earth's surface, and includes the space segment and data-handling segment, except that the term does not include any satellite which is intended for (A) national security uses; (B) commercial telecommunications; (C) weather observation and forecasting; or (D) research and development;

(5) "Landsat" means the existing United States land remote sensing satellite system operated by the

Department of Commerce including the D and D satellites and related ground systems; and

(6) "Secretary" means the Secretary of Commerce.

AUTHORITY OF THE SECRETARY

SEC. 4. (a) IN GENERAL.—The Secretary shall be responsible, in accordance with the provisions of this Act, for—

(1) the management and general oversight of the existing United States land remote sensing satellite system (including Landsat D and D);

(2) the operation of existing space and data-handling segments, including the leasing or contracting of such operation to the private sector, if the Secretary determines such operation to be feasible and cost effective;

(3) the supervision and oversight of any nongovernmental entity or entities operating any land remote sensing satellite system;

(4) determining the basic requirements of the Federal Government for land remote sensing satellite data; and

(5) assuring data continuity beyond the existing United States land remote sensing satellite system.

(b) OVERSEEING THE EXISTING SYSTEM.—The Secretary shall acquire from the National Aeronautics and Space

Administration all portions of the existing United States land remote sensing satellite system, except for those portions which are devoted solely to research and development. Data from any research and development portion of such system should be made available as soon as possible for the purposes of this Act.

(c) DATA CONTINUITY.—(1) The Secretary shall prepare a comprehensive overall plan, with periodic amendments as necessary, for the management of the existing United States land remote sensing satellite system, including—

(A) procuring or acquiring launch services;

(B) launching Landsat D as soon as possible after Landsat D is no longer in operation;

(C) operating and maintaining the existing space and data-handling segments, including methods for reducing costs; and

(D) leasing or contracting the existing space or data-handling segments, or both, to the private sector.

(2) The Secretary shall establish a competitive process that seeks to provide data continuity after Landsat D is no longer in operation. Such process shall be based primarily upon—

(A) the Secretary's determination of the potential availability of cost-effective commercial United States land remote sensing satellite systems; and

(B) those conditions which will stimulate and foster efforts by the private sector to provide data continuity.

In determining whether a United States land remote sensing satellite system is cost-effective under this paragraph, the Secretary shall consider various basic requirements of the Federal Government for land remote sensing satellite data as compared to the cost of providing such data.

(3) The Secretary shall encourage the private sector to develop United States land remote sensing satellite systems which will meet the basic requirements of the Federal Government for such systems after Landsat D is no longer in operation. To increase the viability of private ownership and operation of United States land remote sensing satellite systems, the Secretary shall promote the use, sale and distribution of Landsat data and data products. The Secretary may guarantee any lendor or lessor against loss of principal and interest or other contractual commitments on leases or loans issued to finance development of such systems. If the private sector can not be encouraged to develop such systems, the Secretary may undertake to purchase for the Federal Government a land remote sensing satellite system that will meet such basic requirements.

(4) When Landsat D and D are no longer in operation, the Secretary shall facilitate the transfer or lease to the pri-

vate sector of assets and facilities of the space and data-handling segments. Any such transfer or lease shall be conducted on competitive basis.

(d) Cooperation With Other Agencies.—The Secretary shall coordinate the operation of the existing United States land remote sensing satellite system and the regulation of any commercial United States land remote sensing satellite system with each department or agency of the Federal Government interested in such system or its data.

(e) International Negotiations.—The Secretary, with the guidance of the Secretary of State, may hold discussions with international bodies or foreign governments in order to carry out the policies, purposes, and provisions of this Act.

PROHIBITION OF REPRODUCTION FOR SALE OR DISTRIBUTION OF DATA AND BASIC INFORMATION PRODUCTS

Sec. 5. (a) Prohibited Acts.—(1) It shall be unlawful for any person to reproduce for sale or distribution, or to sell or distribute, any data or basic information product produced by the existing United States land remote sensing satellite system, except in accordance with conditions specified by the Secretary. In setting forth such conditions, the Secretary shall consider the fair use of data by agencies of the

Federal Government, and for teaching and research purposes.

(2) Notwithstanding any other provision of law, no data obtained from any commercial United States land remote sensing satellite system may be duplicated or released by any agent or department of the Federal Government or any other user, except upon prior receipt by the owner of such system of the price of such data, as if such data had been purchased directly from the owner.

(b) PENALTY.—(1) Any person who violates any provision of subsection (a) of this section, or any regulation issued under such subsection, shall be subject to a civil penalty of not to exceed $25,000 for each such violation.

(2) Any such penalty may be compromised by the Secretary. In determining the amount of the penalty, or the amount agreed in the compromise, the appropriateness of such penalty to the size of the business of the person charged and the gravity of the violation shall be considered. The amount of such penalty, when finally determined, or the amount agreed upon in the compromise, may be deducted from any sums owed by the United States to the person charged.

(c) JURISDICTION.—(1) The United States district court shall have jurisdiction, for cause shown, to restrain or enjoin violations of subsection (a) of this section upon petition by the appropriate United States attorney, or the Attorney General on behalf of the United States.

(2) Actions under paragraph (1) of this subsection may be brought in the district where any act or transaction constituting the violation occurred or in the district court where the defendant is found, is an inhabitant, or transacts business. Process in such cases may be served in any other district or where the defendant is an inhabitant or wherever the defendant may be found.

(3) In any action brought under this subsection, subpenas for witnesses who are required to attend a United States district court may run into any other district.

REGULATIONS

SEC. 6. The Secretary is authorized to establish such regulations as may be necessary to carry out the provisions of this Act.

ALLOCATION OF COMMUNICATIONS FREQUENCIES

SEC. 7. Within one hundred and twenty days after the date of enactment of this Act, the Federal Communications Commission shall determine the frequencies for use by United States Landsat and commercial land remote sensing satellite systems. In making such determination, the Federal Communications Commission shall seek the comments of the Secretary. The Federal Communications Commission shall without prejudice permit the development and construction of any

United States land remote sensing system (or component thereof) while any frequency determination is being made.

APPLICABILITY OF THE NATIONAL AERONAUTICS AND SPACE ACT OF 1958

SEC. 8. Nothing in this Act shall be construed to reduce or otherwise affect the authority of the National Aeronautics and Space Administration under the National Aeronautics and Space Act of 1958 (42 U.S.C. 2451 et seq.) to continue the research, development, design, testing, and evaluation of remote sensing components, subsystems, and systems for experimental purposes.

98TH CONGRESS
1ST SESSION

S. 1861

To authorize the development of a new generation land remote sensing satellite, and to ensure the role of the United States as the world leader in developing and utilizing land remote sensing technology through the Landsat program.

IN THE SENATE OF THE UNITED STATES

SEPTEMBER 20 (legislative day, SEPTEMBER 19), 1983

Mr. PRESSLER introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

---

A BILL

To authorize the development of a new generation land remote sensing satellite, and to ensure the role of the United States as the world leader in developing and utilizing land remote sensing technology through the Landsat program.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Land Remote Sensing Satellite Authorization Act of 1983".

FINDINGS, PURPOSES, AND POLICY

SECTION 1. (a) The Congress finds and declares that—

(1) the United States is currently the world leader in developing land remote sensing satellite technology

through the Landsat program, but is in danger of falling behind or completely losing its market to foreign competitors;

(2) land remote sensing from satellites can assist in the proper and rational management of our global resources and environment by providing data on natural and manmade features on and around the surface of the Earth, which is used in such applications as continental crop yield forecasting, pollution control, energy and mineral exploration, disaster control, cartography, urban planning, and land use management;

(3) the public interest is served by the valuable and useful land remote sensing satellite data which are expected to be in greater demand in the future if such data remains available on a continuous, timely, and reliable basis; and

(4) the Federal Government should guarantee continuity of land remote sensing satellite data until the private sector can own and operate a similar system consistent with the findings, purposes, and policies contained herein.

(b) It is declared to be the purposes of the Congress in this Act that—

(1) the United States shall remain the world leader in developing land remote sensing by utilizing

available technological advances necessary to protect our world market against recent advances of foreign competitors;

(2) a new generation land remote sensing satellite shall be built and launched to ensure United States data continuity to our world and domestic market users; and

(3) any United States land remote sensing satellite system shall be operated in a manner consistent with international obligations of the United States.

(c) It is declared to be the policy of the Congress in this Act that—

(1) the United States should take steps to ensure, on an equitable, nondiscriminatory basis, dissemination of data from any United States land remote sensing satellite system; and

(2) all nations have the right to acquire certain data from space systems in outer space and to disseminate that data widely.

AUTHORIZATION OF LAND REMOTE SENSING SATELLITE

SEC. 2. Section 203 of the National Aeronautics and Space Act of 1958 (42 U.S.C. 2473) is amended by adding the following new subsection at the end thereof:

"(d) The Administration is authorized and directed to plan and provide for the development, management, and operation of a civil land remote sensing satellite system utilizing and advancing the developments in land remote sensing technology.".

AUTHORIZATION OF APPROPRIATIONS

SEC. 3. There is authorized to be appropriated such sums as are necessary to carry out the provisions of section 203(d) of the National Aeronautics and Space Act of 1958.

98TH CONGRESS
2D SESSION

S. 2292

To provide for continued access by the Federal Government to land remote sensing data from satellites, and for other purposes.

IN THE SENATE OF THE UNITED STATES

FEBRUARY 9 (legislative day, FEBRUARY 6), 1984

Mr. GORTON (for himself and Mr. GOLDWATER) introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

---

A BILL

To provide for continued access by the Federal Government to land remote sensing data from satellites, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Land Remote Sensing Satellite Communications Act of 1984".

TITLE I—DECLARATION OF FINDINGS AND PURPOSES

FINDINGS

SEC. 101. The Congress finds and declares that—

(1) the Federal Government's experimental Landsat system has established the United States as the world leader in land remote sensing satellite technology;

(2) the continuous collection of land remote sensing data from satellites is of major benefit in managing the Earth's natural resources;

(3) private sector involvement in space can provide sound bases for the future growth of space-based technologies;

(4) it is necessary to determine the extent to which it is appropriate and in the national interest for the private sector to assume responsibility for civil land remote sensing satellite system operation and data management;

(5) the existing civil land remote sensing system of the United States involves important international commitments;

(6) civil land remote sensing involves relevant national security concerns;

(7) it is in the national interest to promote the establishment of private land remote sensing ventures;

(8) land remote sensing development has been inhibited by lack of market development and private industry is best suited to develop the data market;

(9) it is doubtful that the private sector alone currently can develop a total land remote sensing system because of the high risk and large capital expenditure involved;

(10) cooperation between the Federal Government and private industry is necessary to manage effectively the existing Landsat system so as to ensure data continuity, to honor international and national security responsibilities, and to broaden the data market enough to support self-sufficient private ventures; and

(11) such cooperation should be structured to minimize the amount of support and regulation by the Federal Government, while assuring continuous availability to the Federal Government of land remote sensing data.

PURPOSES

SEC. 102. The purposes of this Act are to—

(1) guide the Federal Government in achieving proper involvement of the private sector by providing a framework for gradual commercialization of land remote sensing, allowing an increasing private role as the market for data expands, and assuring continuous data availability to the Federal Government;

(2) preserve the leading position of the United States in civil land remote sensing, preserve the na-

tional security, and honor the international obligations of the United States;

(3) reaffirm the right of all nations to sense the Earth's surface and acquire land remote sensing data, so long as such data are made available to all potential users on a nondiscriminatory basis; and

(4) minimize the duration and amount of further Federal investment necessary to assure data continuity while achieving commercialization of civil land remote sensing.

DEFINITIONS

SEC. 103. For purposes of this Act, the term—

(1) "Landsat system" means Landsat 4 and Landsat D-prime, and related ground equipment, systems, and facilities;

(2) "nondiscriminatory basis" means without preference, bias, or any arrangement that favors any purchaser or class of purchasers over another, such that—

(A) data products are made available to all potential buyers at standard, published prices;

(B) all purchasers are given the same opportunities for access to data, such as timeliness of availability and terms of delivery; and

(C) special arrangements, other than any arrangement for exclusive access to data by any purchaser, such as volume discounts, gathering of data with certain characteristics requested by a purchaser, and maintenance of secrecy regarding any such arrangements, are permissible if the availability and prices of such services are published and uniformly available to all data purchasers;

(3) "Secretary" means the Secretary of Commerce;

(4) "unenhanced data" means digital or minimally processed signals collected from civil land remote sensing satellites involving rectification of distortions, registration with respect to features of the Earth, and calibration of spectral response; the term does not include conclusions, manipulations, or calculations derived from such signals or combination of the signals with other data or information; and

(5) "United States private entity" means any nongovernmental entity or consortium of entities, the majority of whose assets is owned by citizens of the United States, the majority of whose personnel is comprised of citizens of the United States, and whose principal place of business is in the United States.

TITLE II—OPERATION AND DATA MARKETING OF LANDSAT SYSTEM

OPERATION

SEC. 201. (a) The National Oceanic and Atmospheric Administration shall be responsible for—

(1) the orbit and data collection of Landsat 4, and disposition of Landsat 4 upon the termination of its useful operation, as determined and published by the Secretary;

(2) the launch, orbit, and data collection of Landsat D-prime, and disposition of Landsat D-prime upon the termination of its useful operation, as determined and published by the Secretary;

(3) ground equipment and facilities which are used to operate the Landsat system; and

(4) provisions of data to foreign ground stations under the terms of existing memoranda of understanding between the United States Government and nations that operate ground stations.

(b) The Secretary may extend any such Memoranda of Understanding if such extension provides for their expiration upon the termination of the useful operation of the Landsat system.

(c) The provisions of this section shall not prohibit the National Oceanic and Atmospheric Administration from continuing to contract for the operation of the Landsat system, so long as the administration retains—

(1) ownership of the system;

(2) ownership of the unenhanced data; and

(3) authority to make decisions concerning operation of the system.

MARKETING OF UNENHANCED DATA

SEC. 202. (a) In accordance with the requirements of this title, the Secretary shall, to the extent provided in advance by appropriations Acts and in accordance with the provisions of subsection (c) of this section, contract with a United States private entity for the marketing of unenhanced data collected according to the provisions of section 201 of this title. Any such contract shall provide that—

(1) the contractor may set the prices of unenhanced data products, if the products are always available to all potential buyers at published, nondiscriminatory prices and terms of access;

(2) the contractor shall compensate the United States Government for the right to sell the data by payment of an initial fee, a percentage of data sales receipts, or some combination of such fee and receipts;

(3) the contractor shall pay to the United States Govenment the full purchase price of any unenhanced data that the contractor elects to utilize for purposes

other than sale, in accordance with paragraph (4) of this subsection; and

(4) the contractor shall not engage in any sale of processed data except in a manner consistent with applicable antitrust laws.

(b) Prior to entering into such a contract, the Secretary shall publish the requirements of subsection (a) (1) through (4) of this section, and the contract shall be subject to such requirements.

(c)(1) Any decision or proposed decision by the Secretary to enter into any such contract shall be transmitted to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science and Technology of the House of Representatives for their review. No such decision or proposed decision shall be implemented unless (A) a period of thirty days of continuous session of Congress has passed after the receipt by each such committee of such transmittal or (B) each such committee before the expiration of such period has transmitted to the Secretary written notice to the effect that such committee has no objection to the decision or proposed decision. As part of such transmittal, the Secretary shall include the information specified in subsection (a) (1) through (4) of this section.

(2) For purposes of this section—

(A) continuity of session is broken only by an adjournment sine die; and

(B) days on which either House is not in session because of an adjournment of more than five days to a day certain are excluded in the computation of such period.

AWARDING OF THE CONTRACT

SEC. 203. The Secretary shall award any such contract on the basis of—

(1) the financial return to the United States Government, based on any initial fee offered for marketing rights and any percentage of data sales receipts offered to the United States Government; and

(2) the ability to expand the market for unenhanced land remote sensing data.

TITLE III—DATA CONTINUITY AFTER THE LANDSAT SYSTEM

PURPOSE

SEC. 301. It is the purpose of this title to—

(1) provide for a transition from operation by the Federal Government to private, commercial operation of land remote sensing satellite systems;

(2) determine, with minimal risk during the proposed transition period, whether wholly private oper-

ation of land remote sensing is in the best interests of the United States; and

(3) provide for the continuity of land remote sensing satellite data after the termination of the operation of the existing system, as described in title II of this Act.

DATA CONTINUITY

SEC. 302. The Secretary shall evaluate proposals from United States private entities for a contract for the development of a system capable of generating land remote sensing data and marketing such unenhanced data for a period of six years. Such evaluation and any solicitation of proposals shall be conducted by means of a competitive process. Such proposals, at a minimum, shall specify—

(1) the quantities and qualities of data expected from the system;

(2) the projected data upon which operations could begin;

(3) the number of satellites to be constructed and their expected lifetimes;

(4) any need for Federal funding to develop the system;

(5) any percentage of sales receipts offered to the Federal Government; and

(6) plans for expanding the market for land remote sensing data.

NOTIFICATION REGARDING AWARDING OF THE CONTRACT

SEC. 303. (a) The Secretary shall evaluate the proposals referred to in section 302 of this title and, to the extent provided in advance by appropriations Acts, may contract with a United States private entity for the development of a system capable of generating land remote sensing data and marketing such unenhanced data for a period of six years. As part of such evaluation, the Secretary shall analyze the expected outcome of each proposal, in terms of—

(1) the availability to the Federal Government of at least the quantities and qualities of data used by the Federal Government in fiscal year 1983;

(2) the availability of such data upon the expected termination of the Landsat system;

(3) the cost to the Federal Government of developing the recommended system;

(4) the potential to expand the market for data;

(5) any percentage of data sales offered to the Federal Government, in accordance with section 304 of this title; and

(6) such other factors as the Secretary deems appropriate and relevant.

(b)(1) Any decision or proposed decision by the Secretary to enter into any such contract shall be transmitted to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science and Technology of the House of Representatives for their review. No such decision or proposed decision shall be implemented unless (A) a period of thirty days of continuous session of Congress has passed after the receipt by each such committee of such transmittal or (B) each such committee before the expiration of such period has transmitted to the Secretary written notice to the effect that such committee has no objection to the decision or proposed decision. As part of such transmittal, the Secretary shall include the information specified in subsection (a) (1) through (6) of this section.

(2) For purposes of this section—

(A) continuity of session is broken only by an adjournment sine die; and

(B) days on which either House is not in session because of an adjournment of more than five days to a day certain are excluded in the computation of such period.

MARKETING INCENTIVE

SEC. 304. In order to promote aggressive marketing of land remote sensing data, any contract entered into pursuant to this title may provide that the percentage of sales paid by the contractor to the Federal Government shall decrease according to stipulated increases in sales levels.

SALE OF DATA

SEC. 305. Any contract entered into pursuant to this title shall provide that—

(1) the contractor will offer to sell and deliver unenhanced land remote sensing data to all potential buyers on a nondiscriminatory basis;

(2) the contractor will engage in any sale of processed data only in a manner consistent with applicable antitrust laws; and

(3) the contract shall not provide a guarantee of purchases of data by the Federal Government from the contractor.

REPORT

SEC. 306. Within two years after the date on which any such contract becomes effective, the Secretary shall report to the Congress on the progress and feasibility of the transition to total private financing, operation, and ownership of a land remote sensing satellite system, together with any legislative recommendations to accomplish such transition.

TERMINATION OF AUTHORITY

SEC. 307. The authority granted by this title shall terminate ten years after the date of the beginning of any contract entered into according to the provisions of this title.

TITLE IV—PRIVATE LAND REMOTE SENSING SYSTEMS

GENERAL AUTHORITY

SEC. 401. In consultation with other appropriate Federal agencies, the Secretary shall license qualified United States private entities to operate civil land remote sensing satellite systems in accordance with the provisions of this title.

CONDITIONS FOR OPERATION

SEC. 402. (a) No party or consortium may operate any land remote sensing satellite system which is subject to the jurisdiction or control of the United States without obtaining a license pursuant to section 401 of this title.

(b) A party or consortium shall be licensed to operate its system if—

(1) unenhanced land remote sensing data are made available to all potential users on a nondiscriminatory basis;

(2) in the case of a consortium, the system is administered by a central, responsible entity established by the consortium;

(3) no terms of the license issued under this title protect the license holder from fair competition from other license holders;

(4) the license provides that, before any party or consortium terminates its operations under the license, it will make disposition of any satellites in space in a manner satisfactory to the President; and

(5) the entity seeking to obtain the license agrees, as a condition for the receipt of such license, to provide to the Secretary any data generated under such license which the Secretary may request for the purpose of archiving, pursuant to section 602 of this Act.

(c)(1) The Secretary, in consultation with other appropriate Federal agencies, shall be responsible for protection of national security interests and adherence to international responsibilities of the United States which are relevant to operation of private land remote sensing satellite systems, including—

(A) responsibility for all outer space activities of nongovernmental entities of the United States;

(B) liability for damage caused by space objects under registration or license by the Federal Government; and

(C) registration with appropriate international authorities of all objects launched into space by nongovernmental entities of the United States.

(2) In order to carry out paragraph (1) of this subsection, the Secretary shall, before licensing any private land

remote sensing satellite system, secure an agreement from the private entity or consortium that it will—

(A) furnish the Secretary with complete orbit and data collection characteristics of the system, obtain advance approval of any intended deviation from such characteristics, and inform the Secretary immediately of any unintended deviation;

(B) obtain advance approval from the Secretary of any agreement it intends to enter with a foreign nation, entity, or consortium involving foreign nations or entities; and

(C) operate the system in a manner that is consistent with international law.

(3) The Secretary, in order to carry out the responsibilities specified in this title, may—

(A) inspect the facilities or financial records of any entity that holds a license pursuant to this title;

(B) promulgate regulations to implement the provisions of this title; and

(C) provide, within the licenses or regulations issued, for penalties for noncompliance with the requirements of such licenses or regulations, including termination of license and civil penalties.

AGENCY ACTIVITIES

SEC. 403. Federal agencies are authorized and encouraged to engage in joint activities in satellite land remote sensing by forming consortia with private firms, in accordance with the provisions of section 401 of this title, if—

(1) such activities will not compete with United States private sector activities;

(2) such activities are appropriate to an agency's missions and activities; and

(3) appropriated funds are available for that purpose.

TERMINATION

SEC. 404. The authority contained in this title shall terminate at the expiration of ten years after the date of enactment of this Act if no firm or consortium has been licensed and continues in operation under the provisions of this title.

TITLE V—RESEARCH AND DEVELOPMENT

CONTINUED FEDERAL RESEARCH AND DEVELOPMENT

SEC. 501. The Administrator of the National Aeronautics and Space Administration, the Administrator of the National Oceanic and Atmospheric Administration, and the heads of other Federal agencies shall continue land remote sensing research and development, and are encouraged to conduct experimental space remote sensing programs (including applications programs) and to develop remote sensing technologies in support of their authorized missions, using funds appropriated for those purposes. In carrying out such programs, Federal agencies are encouraged to cooperate with private industry.

USE OF EXPERIMENTAL DATA

SEC. 502. Data gathered in Federal experimental land remote sensing programs may be used in related research and development programs funded by the Federal Government, including applications programs, but not for commercial uses or in competition with private sector activities, except as permitted by section 503 of this title.

SALE OF EXPERIMENTAL DATA

SEC. 503. Data gathered in Federal experimental land remote sensing programs may be competitively sold en bloc (consistent with national security interests and international obligations of the United States) to any United States entity which will market the data on a nondiscriminatory basis.

TITLE VI—GENERAL PROVISIONS

OPEN SKIES

SEC. 601. (a) Unenhanced land remote sensing satellite data generated by any system operator under the provisions of this Act shall be made available to all users on a nondiscriminatory basis, in accordance with the requirements of this Act.

(b) For the purposes of this title, the term "system operator" means a contractor under title II or III or a license holder under title IV of this Act.

ARCHIVING OF DATA

SEC. 602. (a) In order to preserve many of the public benefits of civil remote sensing from space, including long-term global environmental monitoring, the Secretary shall provide for long-term storage and maintenance of data, as described in subsection (b) of this section, and for access to such data.

(b)(1) The Secretary shall continue to provide storage, maintenance, and access for unenhanced data from the Landsat system.

(2) The Secretary shall provide storage, maintenance, and access for unenhanced data generated pursuant to title III of this Act. The Secretary may obtain and examine such data to determine whether such data have potential public value, and to store and maintain data that are determined to be of value.

(3) The Secretary may provide storage, maintenance, and access for unenhanced data generated by license holders under title IV of this Act if the Secretary finds that such data have sufficient public value.

(c) All data generated by any system operator under titles III or IV of this Act shall be made available to the

Secretary by the system operator in a form suitable for processing for data storage, maintenance, and access. The Secretary may (as provided in advance by appropriations Acts) pay to such system operator reasonable costs for reproduction and transmittal of the data.

(d)(1) Copies of stored data may not be made available from the archive except (A) to the system operator originally providing the data, or (B) pursuant to paragraph (2) or (3) of this subsection.

(2) Copies of stored data may be made available to persons requesting such copies if the system operator who originally provided the data so authorizes the Secretary in writing.

(3) Copies of stored data may be made available to persons requesting such copies without authorization of the system operator after ten years after the date of the generation of such data.

(4) Persons or system operators requesting and receiving copies of such data from the archive shall pay to the Secretary reasonable costs of reproduction and transmittal.

(5) Nothing in this subsection shall release the Secretary from the Secretary's obligation to provide data storage, maintenance, and access.

(e) In carrying out the functions of this section, the Secretary may use existing facilities or may contract with a private sector party or parties for performance of such functions, to the extent provided in advance by appropriations Acts.

NONREPRODUCTION

SEC. 603. Unprocessed land remote sensing data generated by any system operator under the provisions of this Act may be sold on the condition that such data shall not be reproduced and disseminated by the purchaser.

REIMBURSEMENT FOR ASSISTANCE

SEC. 604. The Administrator of the National Aeronautics and Space Administration, the Secretary of Defense, and the heads of other Federal agencies may provide assistance to operators of remote sensing systems under the provisions of this Act. Substantial assistance, such as launch services, shall be reimbursed by the operator.

RADIO FREQUENCY ALLOCATION

SEC. 605. The Federal Communications Commission is authorized and encouraged to allocate to any license holder under title IV of this Act access to Government radio frequencies and other civil radio frequencies appropriate for land remote sensing systems in a timely manner, consistent with the national interest.

CONSULTATION

SEC. 606. (a) The Secretary shall consult with the Secretary of Defense on all matters under this Act affecting national security. The Secretary of Defense shall be responsible for identifying and notifying the Secretary of those national security concerns of the United States which are relevant to activities under this Act.

(b) The Secretary shall consult with the Secretary of State on all international matters arising under this Act. The Secretary of State shall be responsible for identifying and notifying the Secretary of those international obligations and commitments of the United States which are relevant to activities under this Act.

Senator GORTON. We will begin with Bill Bishop of the Department of Commerce's Source Evaluation Board for Civil Space Remote Sensing. it is a pleasure to welcome you, Dr. Bishop, on behalf of the subcommittee. At this time you may present your oral statement.

STATEMENT OF DR. WILLIAM P. BISHOP, CHAIRMAN, SOURCE EVALUATION BOARD FOR CIVIL SPACE REMOTE SENSING, DEPARTMENT OF COMMERCE

Dr. BISHOP. Thank you, Mr. Chairman.

I am William Bishop, Chairman of the Source Evaluation Board for the commercialization of land remote sensing. I am really quite happy to be here today and happy to testify on behalf of the administration on the three bills before you.

For the record, I would like to enter both my written testimony and one additional remark, and a brief summary of the message contained in my written remarks.

Senator GORTON. It will be included in the record.

Dr. BISHOP. Thank you.

For the record, just orally here today, let me say that I have intentionally not seen, nor discussed the bids that arrived on Monday with my Source Evaluation Board. I will go out to the SEB offices right after this hearing and start my own reading of those bids.

I have avoided seeing the bids so that I will be free to chat with you openly here today.

I do carry a message from the administration, and it is only five points. Let me just state those briefly here.

First, thank you, Senator, and your colleagues, for taking the leadership in introducing this legislation which we in the administration feel is sorely needed.

Second, we feel that what you have before you in the bills provides a good legal framework, and we are generally supportive. In my written remarks, there are some technical comments.

The third message I carry is that our technical comments in general request a bit more flexibility in the contractual terms that the Secretary may seek with a potential winner, and a bit more flexibility in the financial arrangements that he may make with a potential winner.

Furthermore, we raise the question, in those written remarks, about the advisability of putting the Congress directly in the selection path. The Congress has the opportunity, of course, in the appropriations process, to say yea or nay to what the administration may wish to do.

The fourth message I carry—and I am glad to hear it also in your opening remarks, sir—is that we feel a great urgency about seeing some legislation enacted. We have a small window of opportunity here. We in the administration and a number of the bidders have done a lot of ground work; as have both the House and the Senate in introducing legislation.

The final message I carry, which is also in my written remarks, is that the Department is prepared and, in fact, would be delighted to work with you with specific suggested changes and specific language, or any other technical help that the committee may wish in preparing the legislation.

With that, I am happy to answer questions.

Senator GORTON. Thank you, Dr. Bishop.

I will have some questions which I will put orally, and we will submit some additional questions to you in writing.

Dr. BISHOP. Happy to respond, sir.

Senator GORTON. First, I understand that you are prepared today to announce, for the first time, who has responded to the RFP. Is this correct?

Dr. BISHOP. I am indeed, sir.

Ordinarily, the Department of Commerce has a regulation against announcing such things, but we thought that there was enough interest in both Houses of the Congress and also in the public that we ought to waive that regulation this time. And so I am ready to do that.

For the reporter, I have a sheet here, which I will hand her afterward, that has the names spelled out properly, but I will read those.

We have seven bids. They are from the following companies:

The first is GeoSpectra Corp. of Ann Arbor, Mich.

The second is a new company called Earth Observing Satellite Co., or EOSAT for short, of Arlington, Va. This is a joint venture of RCA Corp. of New York City, Hughes Aircraft Co. of El Segundo, Calif., with Computer Sciences Corp. of Silver Spring, Md., as a major subcontractor.

The third is a team headed by Eastman Kodak Corp. of Rochester, N.Y., including TRW Corp. of Redondo Beach, Calif.; Fairchild Corp. of Germantown, Md.; and the Environmental Research Institute of Ann Arbor, Mich.

The fourth is Space America Corp. of Bethesda, Md., a joint venture of AEROS Data Corp. and American Science and Technology, both of Bethesda, with Space Services International of Houston, Tex. The Bendix Corp. of Columbia, Md. and BDM Corp. of McLean, Va. are major subcontractors.

The fifth is Milton A. Schultz of Williston, N. Dak.

The sixth is the Miltope Corp. of Melville, N.Y., a wholly owned subsidiary of Steinbeck Assurance Co.

And the seventh is Space Access Corp. of Marina Del Ray, Calif.

Senator GORTON. Thank you very much.

Could you now tell us about the status of Landsat 5?

Dr. BISHOP. I can.

It was launched, as you know, on March 1. It has gone through all of the systems checkout marvelously. Every system has performed flawlessly.

The only tiny glitch in all of that was one little software problem that we found early on, which was fixed immediately.

The final checkout will be of the infrared channels on the thematic mapper. I believe that is to occur in about a week, and we have every expectation that those will be fine as well.

We have taken data from both of the instruments. We have at least gotten a first look at all of that data, and it appears the satellite is in great shape.

Senator GORTON. Thank you.

S. 2292 would permit the Government to contract for private operation of Landsat 5 and for marketing of data, but not for ownership of the system or data. I feel that the Government has spent too much time and money developing this system to relinquish ownership and final say over operating decisions.

The Department, on the other hand, argues that legislation should permit private ownership to provide experience to a private entity that will ultimately operate its own system.

What experience can actual ownership provide that system operation and data marketing cannot?

Dr. BISHOP. Sir, I am not sure that ownership of the system would itself provide any particular experience.

Our rationale for leaving that option open in the RFP went something like this—and it is alluded to in my written remarks. If the operator is to sell the data, it needs to be his data, or some legislation needs to be enacted allowing the Government to copyright the data and therefore license this successful bidder to sell the data.

Ownership of the system avoids that complication by allowing the successful bidder to market data that he obviously owns because it would be from his system.

However, operation of the system does offer an advantage. It is our premise that operation of the system should be market driven, and one of the ways to do that is for the Government to relinquish its authority for making decision on operation. Government decisions authority is specified in your bill, sir, and we suggested that you might want to change that.

Senator GORTON. S. 2292 would allow different contractors for title II, the marketing of Landsat data, and Title III, development of a followon system. I want to provide this option in case a respondent to the RFP had, for instance, the best proposal for a followon system, but no interest in marketing data from Landsat 5.

For similar reasons, my bill would require rather than just permit the Secretary to contract for marketing of Landsat data.

If the Department wanted to award a contract for a followon system only, I want to be sure that another contract would be awarded for marketing of Landsat data, because a private marketing effort is needed immediately to make remote sensing a viable business.

Apparently, the Department feels that that approach in title II is restrictive in regard to the RFP, while I feel that title II allows more options.

Can you explain the Department's position?

Dr. BISHOP. Yes, sir. And it really has very little to do with the ultimate goal. The ultimate goal is to provide a viable commercial operation sometime at the end of your title III contract. I think that is the ultimate goal we all share.

My remarks about title II have to do with what amounts to an additional burden on the Department, should we in fact choose a contractor for title III only. The bill, as we read it, would require us then to run a separate competition for a title II contractor. This is something we can do, of course.

Senator GORTON. The Department feels that a contract under title III of my bill should extend for more than 6 years. I support

Landsat commercialization because I think keeping the system in the Government inhibits market development.

I am afraid, however, that a contract of extreme length would have the effect of freezing technology.

What benefits of a longer contract override the risk of inhibiting technological development?

Dr. Bishop. Let me say, sir, that the Source Evaluation Board established a maximum contract period of 12 years from the initiation of the overall contract, or perhaps 10 years for your title III. In setting such a period we made a trade between shortening the period to reduce the risk to the Government and lengthening the period to protect our investment.

And we came out in the end, leaning more toward lengthening the period to protect our investment, to give us the largest leverage on assuring the development of a viable commercial entity in the end.

But as to your direct question about freezing the technology, first of all, we feel that the technology ought to be market driven. And, therefore, if there is a market for the products of a higher technology, we rather expect the system will have to respond to that market.

The longer period allows the winning bidder to probably go through two systems, that is, one system change, if the market demands that. So, in fact, it may be that the longer contract is a way of the Government supporting a higher technology, or at least leaving the option open for the Government to support the higher technology.

Finally, sir, in the RFP, we said two things. One, in many places in the RFP, we said we encourage higher technology and innovation. And we also stated in the RFP that it was the SEB's understanding that the Government would continue an aggressive R&D program in technology. So there would be some technology push as well.

Senator Gorton. Later this morning, we will hear the argument that requiring private remote sensing ventures to obtain licenses is a bad idea.

According to your understanding of the Convention on Registration of Objects Launched into Outer Space and of the Outer Space Treaty of 1967, is this licensing requirement necessary, and if not, do you feel it is desirable? Thus, do you think that the licensing requirements in S. 2292 are appropriate?

Dr. Bishop. Sir, I cannot speak for the administration on that, but if you will allow me, I can give my own views on it.

I am not expert in the treaties. I looked briefly at those as we were preparing the RFP, and it struck me that both the Convention on Liability and the Convention on Registration of Objects in Space imply a need for the governent to take a role. I did not see a stricture in those that would require it.

Second, in my history in the Federal Government, I was in a regulatory job for a while, and at that time I came to believe in the protecting of public health and safety, or where the national interests, or international policy or national defense reasons were involved, that licensing was probably a good idea.

The administration has no substantive problem with the licensing provisions either in your bill or in the House bill, sir.

Senator GORTON. If no legislation is enacted to permit commercialization, at what point do you anticipate that the Department would seek an alternative course of action, and what do you believe that alternative would be?

Dr. BISHOP. Sir, I have not talked with the Secretary about what he sees as the backup plan, nor have we prepared a backup plan for him. We are proceeding on a sort of a success-oriented scenario with this.

I think that is a mode of action you have heard from our colleagues at NASA from time to time.

When we would do it would be a function of the budget process, as you are aware. What we would do, I think, would depend on feasibility and cost.

As I look through your list of witnesses today, I suspect you will hear some alternatives proposed by them. We have not committed to any of those alternatives. I believe that the Secretary feels if commercialization fails for any reason, either because we get no good deal for the Government through the proposals, or if the Congress fails to enact some legislation in time, that he will do something. But I cannot specify what or when.

Senator GORTON. Section XI of the RFP, entitled "Evaluation of Proposals," lists factors for which proposals will be evaluated. Quality of data is not mentioned.

Does this omission mean that all qualities of data that meet the RFP's minimum standard, multispectral scanner, will be looked upon equally?

Dr. BISHOP. No, sir.

In several places in the RFP, we mention encouragement on the part of the Government for newer and better things; innovation we call it, or improvement. And in fact, in the chapter 11 that you cited, there is an evaluation factor called understanding the requirements, in which the words "improvement" and "innovation" are used.

Finally, in addition, if the market really is driving toward a higher quality product, I expect we will see that in the marketing plans, and it will get evaluated again in our review at the marketing plans.

Senator GORTON. In the view of the source evaluation board, what does "open skies" mean, and how should it be addressed by this legislation?

Dr. BISHOP. Open skies is the theory, sir, that any nation should be allowed to take remote sensing data from space. Within the open skies policy is the practice of the Government in making data so taken available in a nondiscriminatory way.

The administration's view, in developing the RFP, was that some flexibility in that past practice could be allowed to the bidders. Your legislation would not allow that flexibility. I, frankly, believe that will not be a serious problem in evaluating the bids, and expect the bidders to have taken that into account. In the RFP we asked the bidders to take congressional views into account.

Senator GORTON. Thank you.

Senator Pressler is here with us at this point, and we would be delighted to have an opening statement and/or hear his questions of Dr. Bishop?

OPENING STATEMENT BY SENATOR PRESSLER

Senator **Pressler**. Well, thank you very much. I will keep my opening remarks fairly brief.

The potential commercialization of our Landsat satellite system has many farflung implications for the U.S. Government, many private industries involved in land remote sensing, and the everyday man on the street.

Landsat is, indeed, a substantial budget item, but it is very important to our national security, international relations, agricultural and business applications, and scientific research.

Now, I do not suppose there is anyone in this room this morning who is not aware of the special concern I have for the potential impact that Landsat commercialization may have on the EROS Data Center in my home State of South Dakota. The center is a world class operation, and we are extremely proud to have it in our State. But I want to make it equally clear that satellite commercialization is more than simply a parochial interest of mine. The more deeply involved I have become in this issue, the more it becomes clear how far-reaching the national and international implications of the issue are.

I do believe that this system should ultimately be commercialized, but I remain unconvinced that we are ready for the transition today. There are several basic hurdles that remain to be addressed and overcome before we continue.

First, cost. Although I have not seen the RFP responses, all indications and studies show that it will cost more to commercialize Landsat than to continue Government operations.

Second, technology. The issue of defining the Government's baseline data requirements remains unresolved. I firmly believe that, at the minimum, we must maintain the thematic mapper technology as our baseline, but I do not believe that burden should be put on the private company. With the activity of the French, Japanese, Germans, and others in this field, the United States cannot afford to go backward in technological development.

Third, access. Although this issue has been theoretically addressed, I think there is still a definite practical problem in making sure that all users have equal access to the data. If left unchanged, I believe universities, Third World countries, et cetera, would be unfairly discriminated against.

Fourth, archiving. This issue remains unresolved. Of course, the EROS Data Center is the logical Government archival facility, but no decisions have been made on whether we will even retain a Government archive on Landsat data, which I believe is an absolute must.

Fifth, foreign competition. As I mentioned earlier, other countries are quickly outpacing us in this field. I believe we must make a commitment to gain real time access to data from future foreign satellites such as the French SPOT satellite. Completed studies already show that EROS is best suited for this need, and I intend to push for that in any remote sensing package.

In conclusion, these are just some of my concerns in this area. Certainly, they will have to be addressed before I could support commercialization, and certainly I am going to fight to maintain and increase the role of the EROS Data Center in space applications.

I want to see EROS become more heavily involved in foreign satellite capabilities, archiving functions, supplying Government data needs, and an increased role in our own remote sensing and other space research and development programs.

But, just as importantly, I want to make sure that before we go further on this issue, we are certain it is in the best interest of the taxpayers, our national security interests, our friendly allies, and our scientific and technological advancement in general.

With that, I will close my opening statement. I have a couple of questions for Dr. Bishop from Commerce, if I may ask them. You have already covered some of my questions. So this may be somewhat duplicative. Your questions were quite all-inclusive.

You mentioned that you feel the Government should continue a viable R&D program. Could you describe in more detail what you envisage for this R&D program? For instance, could you envisage continuing TM type technology or even more advanced technology, if we get none from the private sector?

Dr. Bishop. The answer to your last, sir, is yes. We laid out in the RFP what our impressions as the source evaluation board were of the advanced plans of the several agencies for R&D in the future. And among those was a very strong technology program at NASA and, of course, in the military as well.

So, yes, sir, I would expect technologies going beyond the thematic mapper to be developed by the Government.

Senator Pressler. Could you describe that in a little more detail, and what you envisage for this R&D program?

Dr. Bishop. I am not an expert, sir, in the agency's advanced plans, but I can recite from memory a few of the things that I know about.

There are a number of microwave remote sensors in NASA's advanced plans, like the synthetic apperture radar and scatterometer for ocean remote sensing. There is also the multilinear array for land remote sensing, and probably for oceanic remote sensing as well. There are technologies, on the drawing board at least, for what are called "smart 'sensors—sensors that can make some of their own decisions with computers onboard, and send down only the data of interest, instead of the enormous stream of data that we now send down.

There are technologies to improve resolution, both spectrally and spatial resolution on the ground. And there are technologies for data analysis. All of these are part of those advanced plans.

Senator Pressler. Do you think it would be feasible to fly a platform with Government R&D-type sensors in conjunction with private sector sensors if the contractor did not maintain TM or better quality data?

Dr. Bishop. I am not sure that the quality of data that the contractor would maintain would be entirely relevant to whether the R&D censors could be flown with it.

We have a long experience in the meteorological satellites of flying R&D experiments in parallel, sometimes aboard the same spacecraft with the operational instruments. And those R&D instruments lay no requirements on the operational system about the quality of the data from the operational system. I think our experience in the operational satellites is that we can carry on two parallel programs quite comfortably.

Senator Pressler. Without wasteful duplication? Do you think it would get done if the Government did not do it?

Dr. Bishop. I have some concerns about that which grow out of our experience in the communications satellites. There both the private sector and the Government assumed the other party was going to do the R&D. I would hate to see that situation derive from this commercialization activity in land remote sensing, where neither party carried out the R&D.

Senator Pressler. I know we have been struggling with this issue for some time, and yesterday I believe you began a review of the RFP responses.

Dr. Bishop. My colleagues did, sir. I did not.

Senator Pressler. They did not send your colleagues this morning.

Dr. Bishop. That is right.

Senator Pressler. Nor the Secretary.

As I mentioned in my opening statement, the cost of Government subsidization is a key concern of mine, along with a number of other related issues. You talk about a market-driven program. I think we would all like that, but I think that all this implies pretty heavy Government subsidization, and I think that should be understood.

If I understand your statement correctly, you purposely want to avoid giving specific information such as the Government subsidization costs on the RFP responses. When can we expect to receive this type of information?

I have a hard time understanding how Congress can make an intelligent decision without it. What is the timetable?

Dr. Bishop. Let me make one remark, and then try to answer your timetable. The Secretary has said on the record that he is going to get a good deal for the taxpayer, and so I can assure you, sir, that if I take to him a set of proposals, all of which cost more than it would cost to continue the Government system, that he will probably throw me out of his office and say we have got no good bid.

Senator Pressler. What is that again? If you said what, now?

Dr. Bishop. If I took to him a set of analyzed proposals, with the suggestion that he pick one, and they all cost more than it would cost to carry on the Government system, I am sure my recommendations would be rejected.

As to the timetable, the Secretary has us on a very short timetable. In correspondence with the House and Senate Appropriations Committee, the Deputy Secretary has stated that we plan to come to the Congress toward the end of May, perhaps the first part of June, with the Secretary's decision to discuss with you the details.

Senator **Pressler**. When is that?

Dr. **Bishop**. Toward the end of May or the first part of June.

Senator **Pressler**. Good.

Now, if the studies show that it will cost more to commercialize than present—my colleague is writing a question here for me—I guess the point is that the studies show that it is going to cost more to commercialize than it presently costs.

Would you agree with that?

Dr. **Bishop**. I have seen those studies that show that. We have run some very crude models of a business, and it shows that it would certainly not cost the Government as much to commercialize—under any kind of reasonable assumptions that we could generate—as it would to continue the present Landsat system.

Senator **Pressler**. That is all I have for now.

Senator **Gorton**. Fine.

There are likely to be other questions for the record, Mr. Bishop, including some from the minority. In any event, we thank you.

[The statement follows:]

STATEMENT OF WILLIAM P. BISHOP, CHAIRMAN, SOURCE EVALUATION BOARD FOR CIVIL SPACE REMOTE SENSING

Mr. Chairman and Members of the Committee, my name is William P. Bishop. I am the Chairman of the Department of Commerce's Source Evaluation Board for Civil Space Remote Sensing (the "SEB"). I am pleased to be here today to testify on behalf of the administration concerning S. 1855, S. 1861, and S. 2292, titled Land Remote Sensing Satellite Authorization Acts of 1983, or 1984. I do not intend to dwell on the activities of the SEB during the past several months except to say that the RFP for commercialization of land remote sensing was released on January 3, 1984, and responses were received on March 19, 1984.

Mr. Chairman, I would like to put one point clearly on the record at the outset. In order to be able to testify at these hearings and answer questions which you may ask, I have deliberately not read any of the responses which were received by the SEB nor discussed them with the other Board members. I do not know what those bids contain, and will not know until tomorrow when I first see them. Therefore, my discussion with you today will be based on information developed by the SEB and the larger interagency team and is in no way influenced by the contents of the proposals.

I would like to thank this committee and the members who have introduced the three bills for their leadership regarding this issue. These bills have developed the basis for a practical approach to commercialization. We have especially appreciated the opportunity to work closely with your steps on this matter, and we believe that a solid start has been made.

It is the desire of the administration to achieve commercialization of civil land remote sensing from space as soon as possible.

These bills, with some technical changes which I will discuss below, are an appropriate framework for discussion of how these goals may be achieved. Our comments on these bills reflect in large part the experience of the administration in conducting the RFP process over the last 9 months. One of the lessons we have learned in this process is we don't want to have to do it again; at least not in the near future. It is therefore, of extreme importance that legislation enacted by both Houses of Congress and the RFP prepared by the SEB be consistent on substantive issues. With some minor exceptions, I believe they are consistent.

The procurement process now underway constitutes the most thorough and exhaustive effort to date to determine the next steps in the program to facilitate the transfer of land remote sensing operations to the private sector. It has been an unusually complicated and time consuming action, and it is my estimate that at least 2 months will be required for the SEB to submit its analysis and recommendations to Secretary Baldridge. A number of firms spent considerable time and corporate funds preparing the responses to the RFP. In our view it would be extremely unfortunate if the work of the SEB and these private firms were to be discarded or repeated. It would certainly result in significant and costly delays in the commercialization process. I am very pleased, therefore, that we only have minor changes to suggest. Of the three bills mentioned in your letter of invitation , S. 2292 is the most comprehensive, and having been introduced later, is the most complete. It appears to be the best vehicle presently before the Senate for accomplishing the administration and congressional goal of achieving a commercial land remote sensing system. Thus, S. 2292 is the piece of legislation which I will specifically discuss today.

In addition to these comments, we are prepared to deliver to your staff technical comments as well as specific amendment language for your consideration, which will implement the suggestions in my remarks today.

SCOPE OF THE BILL

First a word concerning the scope of the bill. The short title and findings refer to land remote sensing, while the operative portions of the bill apparently refer to both land and ocean remote sensing. There is no generally recognized operational capability in ocean remote sensing at the present time. Including ocean sensing within the scope of the bill will have the effect of specifying the Government's conditions for the commercialization of ocean remote sensing long before the parameters of such a system or the need for commercialization have been established. This may have the effect of inhibiting innovations in this area. It is the administration's view that the bills' application should therefore be limited to land remote sensing.

COMPATIBILITY WITH THE RFP AND SUBMITTED BIDS

One of our principal concerns, as I indicated above, is that legislation do nothing that would cause us to begin again or to seriously delay the process. Several of the provisions in these bills are more restrictive than the provisions in the RFP. It is our intent in making these suggestions to seek to modify the legislation to a point that it is consistent with the requirements of the RFP. In making our suggestions, we have tried to be sensitive to the intent of the existing legislation.

Section 201, dealing with the operation and data marketing of the existing Landsat 4 and Landsat 5 systems specifies that the U.S. Government, specifically the National Oceanic and Atmospheric Administration [NOAA], shall continue ownership of the system and the unenhanced data and have decision authority over operation. However, a contract winner is entitled to set the prices of and in general market this unenhanced data as he or she wishes. This seems to introduce several conflicts. The contract winner is authorized and permitted to market data which is owned by the U.S. Government. We believe that retention by the Government of title to the data would require provisions in the bill permitting the Government to copyright the data and therefore license reproduction and sales by the contractor. The RFP avoids this requirement by permitting transfer of title as well as the essential physical assets of the Landsat system to the private sector operator, if this is determined to be in the national interest. Thus, the contractor obtains title to the data, is free to market it and is not subjected to a complication of the Government still owning the data. Therefore, we recommend an approach in the legislation similar to that in the RFP. Also, section 201(c) specifies that NOAA must continue to have authority for operational decision. We believe the best way to develop the market is to let the marketplace drive the operation. The RFP allows the possibility for a contractor to take over both ownership and operation of the Landsat 4/5 system, except for ownership of real property. We recommend that the bidders be allowed the same opportunity. This would further make the RFP and the legislation compatible. It is possible that without similar flexibility in the legislation, we could receive an excellent bid that proposes to take over the current system, but his bid would not be valid if legislation were passed prohibiting him from doing so.

Section 202(a) requires that the "Secretary shall" contract for the marketing of data. Although we feel that bidders should have the option, we are concerned that if none elect to market Landsat 4/5 data, then another RFP will be required to meet the stipulation of the legislation. We suggest that the Secretary be "authorized" but not required and that "shall" be changed to "may".

Section 202(c)(1) specifies a very extensive congressional review and approval process. It is our feeling that passage of this legislation by the Congress, without this section, would represent approval of the commercialization process. Further specific approval of the contract by Congress is inappropriate. Congress should set the policy for a transfer; the Secretary of Commerce should implement the policy as the selection official for the contract. We strongly request removal of 202(c)(1).

We recommend that the clause "and other factors that the Secretary of Commerce deems necessary" be added as section 203(3). This addition permits the inclusion of other factors in the entire evaluation process. We agree with the factors in 203(3), but feel that there are other important factors which are noted in the RFP.

Section 303(a)(5) requires an evaluation including "percentage of data sales" to the Federal Government. We allow this as a bid option but feel that we should be flexible and allow the financial plan to take one of many forms to get the best possible deal. Thus, we recommend the change of the subsection to permit other types of repayment of the Federal investment.

Section 303(b)(1) specifies the same congressional review of a contract decision as I discussed in section 202(c)(1). We recommend deletion of this subsection for the same reason.

Section 305.3 dealing with sale of data from the follow-on commercial satellite system stipulates that the contact for that activity shall not provide for any guaranteed data purchase by the Federal Government from the contractor. The RFP clearly states the Government will not enter into an exclusive data purchase arrangement. We have also made it clear that the Government would not necessarily agree to a proposal requiring a guaranteed data purchase. However, we feel that flexibility is to the Government's advantage in this case, and this restriction is not in the best interest of the Government. A financial arrangement of support to the contractor which includes some degree or type of guaranteed data purchase might be of interest both to the proposer and to the U.S. Government. We recommend the less restrictive approach.

Section 303.(a) describes a contract period which will extend for a period of 6 years, while section 307 specifies a termination of authority 10 years after the date of the beginning of a contract entered into under the provisions of this title. There seems to be some uncertainty regarding the intended time span, whether 6 years or 10 years. We feel that a period of time longer than 6 years, more likely at least 8 years after launch, will be necesary for a contractor to reach the state of full financial viability. The two times specified in the legislation may lead to some degree of confusion in the awarding of the contract. We prefer the longer authority of up to 10 years.

In order to permit maximum financial flexibility in the bidders arrangement with the Government, we recommend that the phrase "such as launch services" be removed from section 604, and the phrase "except as otherwise authorized by law" be added.

Mr. Chairman, let me conclue my prepared statement by reiterating what I stated at the outset, that these three bills and in particular the more detailed one, S. 2292, constitute a major step forward toward establishing the legal framework for a U.S. commercial land remote sensing system. We look forward to the passage of this legislation by the Senate, similar legislation in the House and the commercialization of land remote sensing.

I would be very happy to answer your questions at this time. Please bear in mind that I have not read any of the proposals as submitted, and therefore would not be able to answer any questions dealing with these proposals.

[The following information was subsequently received for the record:]

ANSWERS TO QUESTIONS OF SENATOR GORTON

Question. Why does the Department of Commerce oppose the inclusion of the phrase "Such as launch Services" in Sec. 604 of S. 2292?

Answer. Mr. Chairman, the Department would favor the greatest possible flexibility in financial arrangements that it might make with a winning bidder. It is conceivable that an exchange of services between the Government and the private bidder could be a part of a very attractive financial package. The removal of specifics from section 604 provides a little bit of additional flexibility for the Secretary in selecting the best deal for the taxpayer.

Question. Understanding that we would like to maintain an adequate archive for remote sensing data, can you suggest language to amend the archiving provisions of S. 2292?

Answer. Mr. Chairman, we would be happy to suggest some specific language. Section 602, as presently written could be interpreted to require the Government to maintain the operator's inventory. To make a clear distinction between the inventory maintained by the operator for sale on the open market and an archive maintained by the Government for scientific and historical purposes, we would propose the following specific language for Section 602.

"(b)(1) The Secretary shall continue to provide storage, maintenance and access for unenhanced data from civil land remote sensing systems, including, in his discretion, such data from the Landsat system, the system operated pursuant to title III of this Act, and any system licensed pursuant to title IV of this Act.

"(2) Storage, maintenance and access shall be undertaken only with respect to data which the Secretary, following established archiving practices, determines to have real or potential value to the Nation.

"(3) Data stored pursuant to this section shall remain distinct from any inventory of data maintained by any system operator.

"(c) Copies of all data generated by any system operator under titles II, III, or IV of this Act shall promptly be made available to the Secretary by such system operator in a form suitable for processing for storage, access and maintenance. The Secretary is authorized, subject to appropriations therefore, to pay to such system operator reasonable costs for reproduction and transmittal of such copies.

"(d) (1) Any system operator shall have the exclusive right to sell all data generated by such operator for a period not to exceed ten years from the date such data are generated. During the ten-year period, the Secretary shall not engage in any activity which infringes upon this right.

"(2) Any system operator may at any time relinquish, with respect to any data generated by such operator, his exclusive right to sell such data. Such relinquishment shall be transmitted in writing to the Secretary.

"(e) Following the relinquishment or expiration of such exclusive right to sell data, the data shall be in the public domain and may be distributed by the Secretary at prices reflecting the reasonable costs of reproduction and transmittal.

"(f) In carrying out the function of this section, the Secretary may use existing facilities or may contract for the performance of such functions, to the extent provided for in advance by appropriations acts."

Question. The Department raised some questions about Sec. 605 of S. 2292. How does the Department feel allocating of radio frequencies should be addressed in the legislation?

Answer. Mr. Chairman, the Department would recommend a minor modification in Section 605 to read as follows:

"Sec. 605. (a) The Federal Communications Commission, with the concurrence of the Secretary, may grant to any license holder under title IV of this Act—

(1) access to government radio frequencies; and

(2) other civil radio frequencies as appropriate for civil land remote sensing systems.

"(b) The Secretary, acting through the Administrator, National Telecommunications and Information Administration, shall allocate such government radio frequencies for use by license holders as he deems necessary and appropriate."

Question. S. 2292 would permit title II or title III contractors to engage in value added activities only in accordance with anti-trust laws. This means that a contractor would have to set up a separate subsidiary with no competitive advantages in order to legally engage in value added activities. Would creation of a separate subsidiary by such a contractor constitute Government supported value added activities, or would it be permitted by the RFP?

Answer. Mr. Chairman, I do not believe that creation of a separate subsidiary by such a contractor would constitute Government support for value-added activities. In fact, our intention in the RFP was to make clear that we would not provide any support to the contractor that could be directly attributable to the value-added function itself. As long as a separate subsidiary is not directly charging to the Government contract, and as long as that separate subsidiary and the parent company were complying with anti-trust laws, they would fit within the framework of the RFP. I believe the contracting officer will have adequate tools to assure us that the Government will not be supporting the value-added functions of the company.

ANSWERS TO QUESTIONS OF SENATORS HEFLIN AND HOLLINGS

Question. Based on your testimony, it appears that with the exception of minor problems with Title II and the Congressional Review Provision in Title III, the Department has no serious problems with S. 2292 and that the bill is compatible with the RFP. Is this a valid representation?

Answer. Sir, that is a valid representation. We have covered, in my written remarks, those areas where we still maintain some small concern. A prime objective is that the legislation not create any obstacles to completing the RFP process. The detailed provisions of Title II appear to us to be the place where the RFP and the legislation differ significantly enough to create concern. We fear that those differences might result in a court overturning an award under the RFP as inconsistent with the legislation. We urge that, unless you have specific reasons for not doing so, you include language in Title II which would clearly authorize the commercialization process the Administration has adopted for inclusion in the RFP.

Question. There has been much discussion as to whether or not MSS or TM, or either, should be established as a baseline. Would you please describe the thinking behind the establishment of MSS as the baseline in the RFP?

What impact will this have on the development and commercialization of more advanced remote sensing technologies?

Shouldn't the "Quality and Quantity" of data be a factor in the Department's Evaluation of the submissions?

Answer. The thinking behind making the MSS a baseline in the RFP was rather simple and consisted of three components. First, the thematic mapper is not yet an operational instrument, and so has not been used by any of the government agencies in an operational way. Second, the agencies could not specify a precise need for land remote sensing data in the future, although they could specify generic uses, and those were laid out in the RFP. Third, the SEB, and the rest of the interagency team, felt it important that we not take a step backward technologically from the instrument that has been operational. I might add that we did encourage improved technology in the RFP.

We hope that the market will drive technology to best serve the market. Therefore, if a capability greater than that represented by a Mess-like instrument is required for a market sector, we would expect that instrument to be offered by anyone who wishes to reach that market sector. The setting of a baseline was merely to establish the minimum which the government would consider. It was in no way meant to limit the technology that might be offered.

The quality and quantity of the data to be offered is a factor in the Department's evaluation of the submissions. It is contained within the evaluation factor entitled "Understanding the Requirements".

Question. Based on the testimony submitted by the private sector panelists who will testify today, there are two key elements to the successful commercialization of the Landsat System: An aggressive marketing strategy and users who are assured of the continuity of data. If this strategy for success is indeed valid, it would imply that the Department should be doing something to assure the continuity of data. Would you please indicate what the Department's position is concerning the continuity of data and what measures are being pursued by the Secretary in case none of the bids are acceptable or in case the acceptable bid does not insure continuity of data?

Is it not true that when the Cabinet Council approved the commercialization of Landsat that it also rejected Secretary Baldrige's recommendation to provide an additional $15 Million in the Landsat budget for long lead parts—a critical component of a commitment to data continuity?

One fallback position that is being discussed to insure data continuity is the on-orbit repair of Landsat 4. Could you comment on this proposal and the current status of negotiations with NASA to utilize a shuttle mission for this objective? Is there any chance that the 3-year life of Landsat 5 could be extended by the use of on-orbit repair and addition of more propellant?

Should language, comparable to that in H.R. 5155, be included in the Senate bill to provide the Secretary of Commerce with the Authority to assure MSS data continuity by procurement and operation by Federal Government if no acceptable proposals are submitted? Does the Secretary already have the necessary authority?

Answer. The Department of Commerce is convinced that the continuity of data is an important component of a continuing system. In the RFP we have indicated that this will be among the several evaluation factors. The current Administration position is that the government will construct no additoinal satellites beyond Landsat 5 for government operation. The Secretary has said that should we be unsuccessful in commercializing Landsat, he would discuss the issue of continued government operation of the Landsat system with the President.

I am not at all convinced that the long-lead parts for Landsat D" are "a critical component" of a commitment to data continuity. However, I believe you accurately described the situation with regard to the Secretary's recommendation.

I think we would be quite supportive of the technology demonstration for these capabilities. But I'm not sure it would be wise to stake the future of an operational program on a technology which has yet to be fully demonstrated. While I'm aware that NASA has such a mission under discussion, I am not privy to the details of their planning for it. It is our plan that once Landsat 4 shows clear indication of reaching the end of its useful life, NOAA will bring it down to an orbit altitude that the shuttle can reach in order that such a repair mission could be attempted.

Mr. Chairman, the Secretary does not currently have the authority. We are unable to support any language in the bill which would grant him the authority to procure additional land remote-sensing satellites.

Question 4. The RFP required the bidder to indicate where legislation is required. Could you please indicate the Department's thinking concerning this provision? What legislative vehicle do you intend to utilize? Will you wait until you have made the final selection or should the Committee plan to incorporate these legislative recommendation into a Landsat bill?

Answer. It is our hope that no authority beyond that under consideration in the Senate Bill before you today and in the House legislation would be required. The requirement in the RFP that bidders address any additional needed legislation was placed there to give the bidders the largest possible flexibility in constructing their proposals. If additional legislation is necessary, we would hope to be able to propose it quickly enough to allow you to incorporate it in this bill, if you so choose, prior to final enactment.

Question. The RFP states that the cost to the Federal Government will be a major factor in the review of the proposals and, indeed, the RFP offers several examples of possible short-term Government Financial assistance. Does the Secretary have the required authority to provide the financial assistance referred to in the RFP or is legislation required? In particular, does he have the authority to provide loans and loan guarantees?

Answer. Sir, it is my understanding that the Secretary does not presently have adquate authority to provide loans and loan guarantees.

Question. For the record, could you please provide the Committee with a description of the current Landsat operating contract. Include in this description the name of the contractors, the type of contract, the cost to the Federal Government, the duration, etc. At the same time, for the record, will you please submit a table reflecting operation costs and Landsat data sales revenues since NOAA assumed control of the program in 1979. Also, please attach the applicable pricing schedule for each of these years.

Answer. The current Landsat operating contract is a Cost Plus Award Fee contract for the maintenance, operation and technical support of the Ground Segment Facility for Landsat D and D' which is located at the Goddard Space Flight Center, Greenbelt, Maryland. The prime contractor is Computer Sciences Corporation. Subcontractors include: Ford Aerospace Corporation, Digital Equipment Corporation, International Data Base Systems, Floating Point Systems and Hewlett Packard Corporation.

The duration of the contract is base year plus three option years. The contract was initiated in October 1982 and the first option year began in October 1983. The contract cost was $7,740K in FY 1983 and the estimated cost for FY 1984 is $9,941K.

Landsat Operations costs and data sales are:

[In millions of dollars]

	Fiscal year—	
	1983 actual	1984 estimated
Cost:		
Direct funds	15.0	21.6
Reimbursed from Fed agencies	7.0	11.7
Total Landsat operating cost	22.0	33.3
Revenue:		
Foreign ground stations	4.3	5.2
Sales and distributions fees	1.8	1.9
Total revenues	6.1	7.1

Attachment A is the pricing schedule you requested.

ATTACHMENT A.—NOAA PRICES FOR LANDSAT PRODUCTS AND SERVICES NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, D.C. APRIL 1, 1983

Type of product/service	Return beam vidicon and multispectral scanner		Thematic mapper		
	Present	Effective Feb. 1, 1985	Present	Effective Oct. 1, 1983	Effective Feb. 1, 1985
Image products:					
70 mm film Pos (B&W)	$26	$30	(1)	(1)	(1)
70 mm film Nec (B&W)	32	35	(1)	(1)	(1)
10 in film (B&W: Pos)	30	35	$38	$50	$75
10 in film (B&WL Neg)	35	40	42	60	80
10 in paper (B&W)	30	35	33	50	75
20 in paper (B&W)	58	65	70	95	140
40 in paper (B&W)	95	105	115	150	200
10 in film (color Pos)	74	80	105	140	190
10 in paper (color)	45	50	75	115	170
20 in paper (color)	90	110	135	200	235
40 in paper (color)	175	195	235	275	290
Digital Products:					
MSS Computer Compatible Tape (CCT), (full scene. 9 track, 1,600 or 6,250 BP1, 1 tape)	650	730			
RBV CCT single subscene (9 track, 1,600 or 6,250 BPI, 1 tape)	650	730			
RBV CCT full scene (9 track, 1,600 or 6,250 BPI, 4 tapes)	1,300	1,460			
TM CCT full scene (9 track, 1,600 or 6,250 BPI, 4 tapes) [2,3]			[4]2,800	3,400	4,400
TM CCT, quarter-scene (9 track, 6,250 BPI, 1 tape) [2]			[2]750	[2]925	1,350
Services:					
Color composite generation	195	220	290	305	325
Retrospective Orders to GSFC Archive				(5)	(5)
Special Acquisition:					
Delivery of MSS HDT via Communications Satellite—per scene	790	885			
Delivery of Standard MSS imagery (not color composite)—per scene	880	985			
Delivery of MSS CCT or HDT—per scene	1,000	1,120			
Acquisition of customer specified TM scene				[6]1,200	[6]1,600
Surcharge for color composite generation for customer ordering acquisition—per scene	150	170	250	[6]250	[6]275
Surcharge for specified minimum cloud cover—per scene	250	275		[6]250	[6]275

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[1] Not offered.

[2] 1,600 BPI tapes will be available: number of tapes to be determined.

[3] Expected to be available in mid- or late-1983.

[4] TM SCROUNGE data is available on 9 track, 6250 BPI, 3 tapes or 1,600 BPI, 7 tapes.

[5] To be provided later.

[6] TM Special! Acquisitions may be implemented earlier than February 1985.

Question. In your statement you indicate that "retention by the government of title to the data would require provisions in the bill permitting the government to copyright the data and therefore license reproduction and sales by the contractor." For the record, would you please supply the Committee with the language that you feel best remedies this problem while still maintaining government title to the data?

Also, would you please indicate how the current contractual relationship at EROS works as regards the processing, archiving and sale of Landsat Data?

Based on the testimony of Mr. Doyle Frederick, would it not be possible for the government to maintain title to the data and "lease" or "contract" with the contractor to provide the services now provided at EROS?

Answer. Mr. Chairman, we would recommend the following language to address the copyright issue in Sec. 204: "Notwithstanding any other provision of law, data sensed by the Landsat system, as defined in section 103(1) of this Act, shall be subject to copyright by the Secretary under the copyright laws of the United States."

EROS provides the final processing and distribution of MSS data, reproduces and distributes the TM data, and services the orders and billing for NOAA on a cost reimbursable basis.

The decision to transfer Landsat operations was made in 1979. However, NOAA did not officially take over the function until January 1983. The service contract was started up 3 months earlier in October 1982.

Operations costs do not include TM processing. TM processing is performed by NASA. NOAA will assume TM operations in January 1985.

I believe it would be possible for a portion of the EROS data center to be made an integral part of the winning bidders operation, at least for some period of time. Of course, this is only one of many possible ways of configuring the existing Landsat system.

Question. In your statement you indicate that Section 303(a)(5) would restrict your flexibility in reviewing the proposals that have been submitted. Do you have specific recommendations as to the "other types of repayment of the Federal investment" that should be included in this bill? Or should the bill be amended to include "and other factors that the Secretary of Commerce deems necessary?"

Answer. We would favor including the phrase "and other factors that the Secretary of Commerce deems necessary". We further feel that a rebate or a profit sharing with the government is only one of many financial arrangements that could prove attractive to the government and the potential contractor. Requiring that arrangement merely reduces the flexibility of the Secretary to select the best deal for the government.

Question. In your discussion of the contract period provided for in S. 2292, you indicated that you would prefer the 10 year period in lieu of the six year period. For the record, will you please submit a copy of the financial plan developed by the Department that justifies this extended contract period? What basic assumptions are associated with the RFP's 12 year contract? What is the difference in cost to the Federal Government between a 6 year contract and a 12 year contract? How many launches would be supported during a 12 year contract as compared to a 6 year contract? Would a 6 year contract give the contractor enough operational and marketing experience to commercialize Landsat and compete with potential foreign competitors?

Answer. The Department did not prepare a "financial plan" to justify the extended contract period. We felt that it was in the best interest of the government to allow a considerable amount of flexibility in the contract period. Twelve years is not a specified contract length, merely a maximum that we would consider. We arrived at 12 years by allowing for 2 years of continued operation of the government's Landsat system, followed by enough time for the operator to get into the second of his operational systems and test that system thoroughly in the market. We felt that we were interested in going beyond the first commercial operating system because, as we found in our R&D systems, the first one to fly does not always perfectly satisfy the end user. We felt it important to allow the government contract to continue into the second operational system if the contractor wished to bid in that way.

In general there is about a 5-year development cycle for any new space system. This would place launch of the second system somewhere near the end of the 1980s. And we felt a few years of operation of that system within the contract was wise. Finally, we did not believe a period as short as 6 years was likely to be adequate for testing the commercialization. Most of the papers that have been presented at conferences in the past, and testimony that has been presented before the House Science and Technology Committee, lead us to believe that a period of about 10 years will be required to develop that market.

Question. Due to the failures of payload assist modules (PAM) in the recent shuttle mission there is cause for concern as to whether or not the shuttle has the capacity to put a satellite into orbit. What if any consequences could this development have on the proposals submitted to the Department of Commerce?

Answer. Sir, we place no restrictions on the operator regarding what launch vehicle he should choose. The launches that might be revelant to a contract under the RFP would be quite a few years in the future—at least 1986 or 1987. We have every confidence that by the time any problems with the payload assist modules will be fully solved. Furthermore, a number of companies assure us that there will be commercially available expendable launch vehicles by about that time. In short, I do not believe that the recent difficulties with the payload assist modules will be of any consequence in the proposals put forward under our RFP.

Senator GORTON. Our next witness is Doyle Frederick of USGS. In the meantime, Kodak, which was asked to testify and was unable to do so, has a brief presentation which will be included in the record.

[The document referred to follows:]

EASTMAN KODAK CO.,
Rochester, N.Y., March 19, 1984.

Hon. BOB PACKWOOD,
Chairman, Senate Committee on Commerce, Science, and Transportation, Russell Senate Office Building, Washington, D.C.

DEAR SENATOR PACKWOOD: I greatly appreciate your invitation to appear before the Science Technology and Space Subcommittee hearing on commercialization of the Government's land remote sensing satellite (Landsat) system on March 22, 1984. I regret that I will be out of the country on business on that date and will be unable to appear.

I very much want to express the support of our company for the provisions of the Gorton bill to achieve involvement of the private sector in gradual commercialization of land remote sensing. This should take place over a time period during which an increased marketing activity for the data output from this system will expand the revenue so that the enterprise will achieve commercial viability.

The on-going program must be timed to maintain continuity of data and also should be configured so that the US retains world leadership in land remote sensing.

We recognize the necessity for this system to support national security and also to house the international agreements made respecting the availability of data.

Sincerely,

C. P. SPOELHOF,
Vice President and Assistant General Manager, U.S. Apparatus Division.

Senator PRESSLER. I might say that this panel includes Al Watkins of Sioux Falls, the head of the EROS Data Center. I am very proud that he is here. He is one of the most knowledgeable men in the country on these issues.

Senator GORTON. Thank you.

STATEMENT OF DOYLE FREDERICK, ASSOCIATE DIRECTOR, U.S. GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR, ACCOMPANIED BY ALLEN H. WATKINS, CHIEF, EROS DATA CENTER

Mr. FREDERICK. Mr. Chairman, Senator Pressler, I am Doyle Frederick, the Associate Director of the U.S. Geological Survey. I am here on behalf of the Department of the Interior. And with your permission, I would like to ask Al to join me at the table.

Senator GORTON. That will be fine.

Mr. FREDERICK. As Senator Pressler says, Al is a foremost authority, and is the Chief of our EROS Data Center.

Senator GORTON. As with the previous witness, your entire written statement will be included in the record. We would appreciate its being summarized orally.

Mr. FREDERICK. Yes, sir. I will briefly summarize the testimony for the Department of the Interior.

I am pleased to be here today. We are focusing our testimony on the basis of your request, and that is the impact of Landsat commercialization on the user end of the business, the national remote sensing program, and on the aspects of commercialization that perhaps might impact the EROS Data Center.

I will note in the beginning that the Department of the Interior has been a member of the Interagency Board looking at Landsat commercialization from the inception. We have people on the Source Evaluation Board, and work with Commerce very closely, and we do support the idea of an orderly commercialization of the land remote sensing program.

We are going to speak from essentially two points of view, as I mentioned, from the user side—and I think the Department of the Interior represents fairly well the Federal Government aspect of Landsat users—and we will also speak on the side that has us as a partner with NOAA in the handling and distributing of the Landsat information.

First, from the user point of view, I would just like to say that the Department of the Interior has many programs that now use Landsat information on a regular basis along with aircraft data and other information collected on the ground and from other sources.

Our managers, planners, and scientists in almost every bureau in the Department of the Interior now use that information in both research and operational programs.

Many of the Interior bureaus now have facilities and trained staff, many of which came from out of the training programs developed through the EROS Data Center, at selected locations throughout the United States. Of course, the Geological Survey has the EROS Data Center, but we also have facilities in Reston, Va.; Denver, Colo.; Menlo Park, Calif.; Anchorage, Alaska—to name a few.

The Bureau of Land Management uses the data through facilities in Denver, Colo. and Anchorage. The Fish and Wildlife Service has facilities in Fort Collins, Colo., Slidell, La., and St. Petersburg, Fla., as well as Anchorage.

Other Interior bureaus—I might mention the Bureau of Reclamation also has a remote sensing facility—and the other Interior bureaus that I have not mentioned use the data regularly through the Sioux Falls facility.

Now, our program as it relates to the Landsat activities is basically carried out through the EROS Data Center in Sioux Falls, as we mentioned earlier. From the inception of the program we have been a partner—earlier with NASA, and now with NOAA—in the archiving and distributing of the Landsat information.

The role in the data processing for the Landsat program, as I say, is a cooperative effort. We are now funded for that aspect of the program by NOAA.

But in addition to that, the data center is responsible for many activities in the Department of the Interior. We suggested a few of those a little earlier. Basically, in addition to the Landsat material, we are responsible for archiving the aerial photographic information that is collected by the Geological Survey. It includes aerial photography; it also includes synthetic apperture radar imagery that has been collected recently, and other information from satellites as well as other aircraft. We are responsible for technology development that looks at the applications of remote sensing data. That includes Landsat as well as all other data, including on-the-ground verification. We sponsor training programs that include all Federal agencies, as well as others on cost repay basis.

The point here is that the EROS Data Center, although it is involved in a substantial way in the Landsat program, is also involved in an even more substantial way in other remote sensing activities of the U.S. Geological Survey and the Department of the Interior.

Now, the Data Center has about 335 people. Sixty of those are U.S. Geological Survey employees. About 275 are contractor employees.

We approached the Landsat data dissemination matter by using the total resources of the Data Center. Less than 25 percent of the total activities of the Data Center are involved in Landsat data archiving and data dissemination. We do use most of our people for common purposes, and we also use most of our equipment for common purposes, including all of those aspects that I just mentioned. About 10 or 12 people are solely devoted to Landsat operations.

From the equipment point of view, there is very little of equipment at the EROS Data Center that would be solely devoted to Landsat operation. And I think the point here is that that was recognized in the RFP and the EROS Data Center equipment and activities were excluded from the RFP.

If the Landsat applications are commercialized, and we believe that indeed can be done, impact on the Data Center would be fairly significant, but we would envision that the Data Center would continue operating to do the kinds of things that I just described; would continue to use Landsat information as well as other data; would continue our research and development program to support the Department of the Interior activities and other Federal Government activities as appropriate; would continue with our training and technology transfer; would also continue the archiving function of the other data that the Department of the Interior will continue to collect.

So, in summary, on that aspect, if indeed the commercialization of Landsat is accomplished, and we believe indeed that it can be, we will continue the operation of the EROS Data Center for the purposes that I have just stated.

We also are looking at other activities that we might place at the EROS Data Center, to continue at a viable level.

Senator Pressler has mentioned earlier that the EROS Data Center is considered as a world class organization, with very capable people, very capable in terms of handling data and information. We are envisioning looking at other Geological Survey functions for perhaps locating at the EROS Data Center. All of those have not yet been put together in terms of a specific plan, but I can assure you that we are working hard on that aspect.

We do indeed believe, from a Department of the Interior standpoint, that continued access to Landsat type information is important to our programs. We think that continued improvement in the technology will indeed be necessary.

I should also mention that, in addition to the use of the existing Landsat 5 data, and data from followon commercial systems, we intend to make use of the data from foreign satellites. We think that they will offer some benefits to the programs, and we would intend to use that information. And we will make the arrangements, either in a consolidated way as a part of a Federal Government approach, or separately, for meeting the Department of the Interior's needs.

With that, Mr. Chairman, I will stop and answer any questions.

Senator GORTON. Thank you, Mr. Frederick.

Senator Pressler?

Senator **Pressler**. Well, thank you.

I am just very proud to have you both here, and especially Al Watkins, who is one of the leading citizens of our State, and we are very proud of him.

I have a number of questions. I want to get back to covering some of the things you mentioned.

First of all, in your testimony, you touched upon the potential impact commercialization may have on EROS, and let me say that I do not take this just as a parochial interest, because I think it is a nationwide concern.

Could you be a little more specific about the amount of funding and number of jobs we are talking about here? For instance, assuming all Landsat functions were removed from EROS, with no replacement capabilities, what amount of funding would be lost, and approximately how many jobs would that translate into?

Mr. **Frederick**. Senator Pressler, we anticipate in fiscal year 1985 getting about $6 million from the National Oceanic and Atmospheric Administration to fund the Landsat data, archiving and data dissemination. In terms of money, it would be about $6 million as we envision it, depending on how the final contract is written and what role, if any, EROS Data Center would play.

But if all of those functions, currently performed for NOAA, were removed, then we would envision a loss of about $6 million.

Now, that would translate, with no additional programs given to the EROS Data Center—I would like to emphasize that this is not the number the Geological Survey would envision, because we would probably compensate somewhat for this. With no additional functions, that would amount to somewhere on the order of 130 people, I would guess.

Senator **Pressler**. I noted that in your testimony, you mentioned there were 60 governmental employees, and the rest were private contractors, so apparently it is already commercialized to some extent.

How does that work?

Mr. **Frederick**. It works very well, Senator Pressler.

We think the mix of Government personnel and contract personnel at the EROS Data Center works very, very well from a cost effectiveness point of view, from a flexibility point of view, and from a talent point of view.

Senator **Pressler**. What are the advantages over having them all be Government employees? Or would it just not work out because of the different nature of the contracts?

Mr. **Frederick**. First of all, when we initially established the EROS Data Center, we had concluded that we could do a better job in attracting people and the talent that we needed to get on board quickly if we used a combination of Government employees and contracts.

We also have to deal, as you know, with personnel ceilings and that sort of thing. It has worked very well from a cost-effectiveness point of view.

Senator **Pressler**. Now, what does the Survey plan to do about that impact? Are you currently exploring alternative assignments for EROS in light of the potential effect of commercialization? You did mention some potential alternatives, even if there was commercialization.

But how would you envisage the EROS Data Center if we had commercialization?

Mr. **Frederick**. Senator, as I mentioned earlier, we envision the Data Center to continue as a central facility for the Department of the Interior in the applications of remote sensing data, all remote sensing data.

In addition, we are looking very seriously at the data center for additional applications of digital carto graphic data. We have within the Geological Survey a program to provide in digital form, the data that is presently shown on our maps so that it can be readily analyzed, combined with other information, and used very quickly for decisionmaking purposes.

We envision that the EROS Data Center will have a large role in that particular program; in particular, the aspect that has to do with the archiving of the data; the public access part.

In addition to that, we are looking at a possible role for the EROS Data Center for other computer-related kinds of information. We just struck a deal with the Department of Energy to move some of the national uranium resource evaluation program data from Grand Junction, Colo., into the EROS Data Center and be the archive for the digital tapes coming from that program.

So it is that kind of thing that we are looking for. We are in the applications end, and more as an archive for the U.S. Geological Survey programs in particular.

Senator **Pressler**. Earlier this morning, it was mentioned that the French are launching the SPOT satellite, which is going to be one of the most advanced remote sensing satellites in orbit up there, as I understand it.

What are the chances of there being a U.S. receiver for that, and what are the chances of that being at the EROS Data Center?

Mr. **Frederick**. Senator Pressler, I guess our position on that—and I am not trying to dodge your question—but our position on that is that yes, indeed, if the SPOT satellite is launched, it provides some technology that we must indeed use. So we will indeed use that data.

The question of whether or not there needs to be specifically a receiver in the United States proper, or whether that ought to be the data center, I expect is yet to be answered. We are not convinced, necessarily, that it has to be at the EROS Data Center in order for us to do the job that we have to do.

There have been discussions within the Interagency Board on that issue, and we have agreed to take a look at least at that aspect of the question that has to do with whether or not there ought to be some sort of consolidated Federal Government approach to the French Government on the data acquisition question.

Senator **Pressler**. I understand that, because of the curvature of the Earth, the location in central United States would pick up signals from SPOT or any satellite better than lots of other points. I know that a lot of people in Washington, D.C. and the agencies would probably rather drive out to Goddard, where they can have lunch and get home that night, than fly out to Sioux Falls, although once they get to Sioux Falls, they are very happy there. And I think Al Watkins will attribute to that.

Mr. **Frederick**. I can attribute to that, too, Senator Pressler.

Senator **Pressler**. But I might just ask Al Watkins about that indeed, we have to make decisions of national importance based on the best location. Al, you have had lots of foreign scientists out there. Tell us about some of those experiences.

As a matter of fact, I just saw some Chinese scientists recently on an airplane heading for Sioux Falls.

Mr. **Watkins**. We do have a large amount of international involvement, Senator, at the center. There is a lot of international interest in the satellite program and in the other things that are going on at the center.

In specific answer to your question about the location of Sioux Falls, it is fortunate to be in the center of the United States, and the center of the United States is a location where one single receiving station could receive data over the whole lower 48 States, the conterminous 48 States. So that is Sioux Falls' claim to fame in that particular case.

Senator **Pressler**. In terms of the curvature of the Earth, that is the best receiving area. It is a better receiving area than the east coast or the west coast, is that not correct? Would you both agree with that?

Mr. **Watkins**. Something close to the center of the country would allow you to use one station.

Mr. **Frederick**. From a physical point of view.

Senator **Pressler**. But from a scientific point of view, aside from any parochial interest that I might have.

Mr. **Watkins**. Geometrically, that is correct, Senator.

Senator **Pressler**. Great.

I wanted to ask one more question, because I do think in terms of the national interest, it is important that we keep up with what the French and the Japanese and others are doing.

Do you think there is a need for real time access to this SPOT data for the United States, rather than being dependent on indirect sales from the French?

This satellite that the French are putting up, I understand, is the most sophisticated, both in terms of military information and domestic information. We will be at a disadvantage if we do not have a receiving satellite, in my view.

Would you agree with that?

Mr. **Frederick**. Senator Pressler, we would agree that there would be perhaps some advantages to direct access to the French system from a technical point of view.

On the other hand, I would not suggest that that would be absolutely critical to the Department of the Interior program.

Senator **Pressler**. We are also looking into the national security concerns, in some meetings that we have arranged with Bud McFarland's office.

Let me just conclude by asking Al Watkins—and you can submit this for the record—on the personnel there, the ability to attract personnel in the community in terms of university opportunities, and so forth. I think that is an important thing to have in the record for the EROS Data Center.

What has your experience been in attracting and retaining personnel there?

Mr. WATKINS. We have been very fortunate.

Senator PRESSLER. How many years have you had at the Data Center?

Mr. WATKINS. Ten years. Since it first started in 1973. We have recruited a staff of Government and contractor personnel, of 350 or so highly competent people. It is surprising that a large number of people from the Midwest welcome the opportunity to stay in a high technology environment that the Data Center offers in the Upper Midwest, and we have been able to attract that type of people quite well.

We have a close association with the two State universities that are very close to Sioux Falls, and the two private universities in Sioux Falls that supply people, the young people that we need to bring in. All in all, I will say that we may have to work just a little bit harder to recruit them, but once they are there, we do not lose them. The turnover rate is very, very low.

Mr. FREDERICK. Senator Pressler, I think I would share Al's opinion. From the Geological Survey point of view, we are very pleased with the EROS Data Center operations and their technical capability, and that would be one of the principal reasons that I would suggest to you that we are seriously considering other applications at the EROS Data Center.

Senator PRESSLER. Well, let me conclude by saying that I am very proud to have Al Watkins of Sioux Falls here. He has done a great job for 10 years in our State, and is one of the leading citizens of our State.

I am concerned about commercialization. I am very skeptical in the short run if we can go that route, but I know that the administration has another position, and your testimony reflects that. But I think you have brought us some very good information this morning.

Thank you.

[The statement follows:]

STATEMENT OF DOYLE G. FREDERICK, ASSOCIATE DIRECTOR, U.S. GEOLOGICAL SURVEY

Mr. Chairman and members of the subcommittee, my name is Doyle G. Frederick; I am the Associate Director of the U.S. Geological Survey (USGS). On behalf of the Department of the Interior, I am pleased to be here today to discuss the potential effects of Landsat commercialization on Interior's remote sensing program and the Earth Resources Observation Systems (EROS) Data Center. Interior is involved in the Landsat program in a number of significant roles. I will note to begin with that the Department is a member of the Interagency Board on Civil Operational Earth Observing Satellite Systems (IB-COESS) and we are fully supportive of the policies and procedures the Administration has pursued in the commercialization of Land Remote Sensing. We are a user of the data for many applications and, we also archive and distribute data through the EROS Data Center of the USGS, in partnership with the National Oceanic and Atmospheric Administration (NOAA).

The Department of the Interior is a strong advocate of remote sensing technology. It was among the earliest to recognize the potential of land remote sensing for resource studies and as a tool in managing the country's land and water resources. Managers, planners, and scientists within the various bureaus of the Department use data from Landsat and aircraft with other forms of topographic and cartographic data and with ground verifications to support geologic analyses, hydrologic assessment, land classification, image mapping, and applications research.

For example, Landsat and digital elevation data have been used to make land cover classifications for about 150 million acres of Alaska lands. Participants in this program include the USGS, Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service, and the State of Alaska. Another 60 million acres of land are being classified this year and we expect to complete the entire state in the next 3 to 4 years. Data bases have been developed for many of the National Wildlife Refuges, where they are used for Refuge planning. Other applications include engineering and water resource planning on the North Slope, and wildfire suppression planning on public lands.

Several Interior bureaus have facilities and trained staff devoted to the analysis of remotely sensed data. Selected locations include USGS (Reston, Virginia; Denver, Colorado; Flagstaff, Arizona; Sioux Falls, South Dakota; Menlo Park, California; and Anchorage, Alaska), BLM (Denver, Colorado; and Anchorage, Alaska), USFWS (Ft. Collins, Colorado; Slidell, Louisiana; St. Petersburg, Florida; and Anchorage, Alaska), National Park Service (Denver, Colorado), and Bureau of Reclamation (Denver, Colorado).

The EROS Data Center was established in Sioux Falls, South Dakota, at the beginning of the Landsat program to serve as a national center to process, archive, and distribute Landsat products to users and to accomplish applications research. The role in data processing for the Landsat program began as a cooperative effort with the National Aeronautics and Space Administration (NASA) and continues today with the NOAA. The Data Center's continuing association with the Landsat program is also demonstrated by its active contracts with foreign ground stations that receive Landsat data and with many international remote-sensing programs.

At the time that the EROS Data Center began to process and distribute Landsat data in the early 1970's, the Department made a commitment to develop a national capability at the Data Center for analyzing all types of remotely sensed data and transferrig this new technology to various program elements of the Department. Over the years, the EROS Data Center's capabilities for image processing, spatial data handling, and technology transfer grew rapidly. Many cooperative projects were accomplished with Interior bureaus, and specially designed training courses were offered to Interior and other Federal agency personnel to help spread an understanding of the potential uses of remote-sensing technology. Active participation by EROS personnel helped several bureaus to establish many of the Department's remote sensing/digital data analysis centers. EROS scientists continue to cooperate with bureau personnel to develop and implement new technology.

At the present time, the Center has 335 employees (60 are Government employees and 275 are contractor personnel). Approximately one-fourth of the Center's resources are devoted to Landsat data handling and processing activities. The majority of the individuals who staff the Center's data handling and distribution activities are involved in both Landsat activities and USGS's aircraft data program. Only 10 to 12 full-time individuals and a few pieces of equipment are unique to Landsat operations. Computer facilities and photograhic processing equipment are also shared between Landsat and other Center activities.

If the Landsat processing activity were to be taken over by a commercial system operator, the Center would continue to serve the wide variety of departmental fundtions that it has addressed for many years, including 1) specialized processing data to meet unique Interior needs (image mapping, enhanced images, geographically registered data sets, etc.); 2) cooperative applications projects using Landsat data as well as many other digital earth science data sets; 3) research and software development, leading to more effective ways to manipulate digital data and use geographic information systems; 4) training and technology transfer; and 5) archiving, processing, and distributing aircraft data products. The EROS Data Center's hardward systems are required to support these ongoing Interior functions. This point is recognized by the Department of Commerce in the Request for Proposals (RFP) for Transfer of the U.S. Land Remote Sensing Program to the Private Sector. The RFP specifically excludes the EROS Data Center's equipment from the assets that offerors may bid to acquire.

We believe that a commercial enterprise can meet the needs of the national program with proper transition, continuation of data collection with no lengthy gaps, and assured technical development. We believe that there is a need for technological improvement in sensor design, data processing procedures, and analysis techniques. Improvements in spatial resolution and spectral sensitivity, and the availability of steroscopic coverage are among the technological advancements needed to ensure increased utility within the Department. The Department intends to continue its remote sensing research and development programs which are designed to meet its specific resource information requirements. We will continue to test, evaluate, and implement new approaches to data analysis and applications using data obtained from new aircraft and satellite sensing systems, including Landsat.

We have undertaken research and development to understand the unique characteristics of each new data type, as well as to explore new ways that new data can be used to evaluate, inventory, and monitor our nation's natural resources. For example, we have found that the improved spectral resolution of Landsat Thematic Mapper (TM) data helps geologists to identify important mineral occurrences that were not revealed on Landsat Multispectral Scanner (MSS) images. As another example, the increased spatial resolution of TM data has permitted the Geological Survey to print more detailed image maps. The recently released false-color satellite image map of the Washington, D.C. area, printed on a scale of 1:100,000 has been shown to meet National Map Accuracy Standards. In this way it is compatible with other maps in our national map series. Other Interior bureaus are discovering that the resolution of TM data also permits them to perform more detailed inventories of Federal lands under their jurisdiction.

We plan to use new data from both the MSS and TM sensors on Landsat 5, and would hope to use data provided by a commercial system operator. Furthermore, foreign sensing systems are being designed with features not offered by Landsat 5 (improved spatial resolution, stereo imaging capability, and microwave spectral sensitivity). We will also want to work with data from these systems to keep aware of the technological benefits offered by these systems.

The Department has made a significant investment in personnel as well as facilities to use this emerging technology. Continuity in the availability of data from Landsat and follow-on systems is important. Many of the applications of Landsat data are relatively new and have demonstrated a cost savings over traditional methods. For those applications requiring current (new) data, a data gap would probably reduce the acceptance of this technology. We have noted that the transition period specified in S. 2292 (6 years) is shorter than the 12-year contract period (including the anticipated 3-year lifetime of Landsat 5) defined in the Department of Commerce's RFP. Therefore, we recommend that the committee adopted a transition period of up to 10 years as suggested by the Department of Commerce, so that the opportunity for successful commercialization can be maximized.

Mr. Chairman, this concludes my prepared statement. I thank you for the opportunity to be here today, and I would be happy to answer any questions at this time.

[The following information was subsequently received for the record:]

QUESTIONS OF THE MINORITY AND THE ANSWERS THERETO

Question. One of the principal roles of the Earth Resources Observation System (EROS) Data Center is to archive Landsat Data.

If the Landsat system is commercialized, what should be the relationship between EROS and the contractor as regards the archiving of Landsat Data? Should separate archives be established for data obtained by the contractor and data obtained prior to commercialization by the government?

Answer. Interior believes that the data acquired by Landsats 1-4, and future data acquired by Landsat-5 and the commercial operators under Title III and IV of S. 2292, is of value-both scientifically and for operational inventory and monitoring programs. We are interested in maintaining the integrity of the current archive of Landsat data, and ensuring that valuable data from future systems are systematically added to this historical data set. We would consider a continuing role for the EROS Data Center as the repository of the permanent archive, either in cooperation with NOAA or private industry.

Question. In your testimony before the Senate Commerce Committee on March 22, 1984, you failed to comment on the proposed archiving scheme included in S. 2292.

Does S. 2292 create a workable solution as concerns the archiving of data? Is S. 2292 compatible with the RFP?

Answer. Section 602 (archiving of data) of the proposed S. 2292 is quite comprehensive and should provide a workable framework to ensure the continued integrity of the archive of current and future Land Remote Sensing data. S. 2292 and the NOAA Request for Proposals for Transfer of the U.S. Land Remote Sensing Program to the Private Sector both specify a continuing government responsibility to maintain and augment a historical archive, and thus they appear to be compatible.

Question. Does the Secretary have the capability to determine whether the data generated by a system operator under Title III or IV of S. 2292 has "potential public value?"

Answer.The purchase of land remote sensing data of "potential public value" from commercial system operators will be a key element in the future usefulness of the historical data archive. We anticipate that NOAA will establish a subcommittee under the Interagency Board on Civil Operational Earth-Observing Satellite Systems (or some other suitable interagency struture) to assist in the determination of the character and amount of data to augment the historical archive.

Question. Should S. 2292 include a copyright provision for remote sensing data?

Answer. Some form of protection from unauthorized reproduction of data is required to protect the investment of the commercial system operators. Commerce, on behalf of the Administration, has suggested in previous testimony on H.R. 4836 that system operators be allowed to copyright their data under copyright laws, (thereby eliminating any question of whether the system operator's legal remedies for violations may be found in contract law or under the copyright laws).

Question. Should data gathered pursuant to title IV of S. 2292 be proprietary?

Answer. The U.S. policies of "open skies" and nondiscriminatory data dissemination have furthered the exchange of scientific and technologic information with other nations of the world, and we anticipate that these policies will continue so long as the government operates the Landsat system. The Request for Proposals for Transfer of the U.S. Land Remote Sensing Program to the Private Sector allows bidders to suggest changes in these policies for consideration by the Administration and Congress. The Administration, however, has encouraged the bidders to adhere to past government practices.

Senator GORTON. Thank you both very much for being here.

Our first panel will consist of Charles Schmidt of RCA Astro-Electronics; Giles Sinkewiz of General Electric; Diana Josephson of Space America; and Klaus Heiss of SPARX.

They will come forward.

Mr. Schmidt, you may proceed. Your entire statement will be included in the record as if read. We are going to limit the oral statements of each of you to no more than 5 minutes.

Would you make your statement?

STATEMENTS OF CHARLES A. SCHMIDT, VICE PRESIDENT AND GENERAL MANAGER, RCA ASTRO-ELECTRONICS; GILES SINKEWIZ, GENERAL MANAGER OF SPACECRAFT OPERATIONS, GENERAL ELECTRIC; DIANA H. JOSEPHSON, PRESIDENT, SPACE AMERICA; AND DR. KLAUS HEISS, CHAIRMAN, SPARX CORP.

Mr. SCHMIDT. I have tried to reduce my written testimony to hit some of the high points.

Senator GORTON. Thank you.

Mr. SCHMIDT. Mr. Chairman, Senator Pressler, my name is Charles Schmidt. I am the vice president and general manager of RCA Astro-Electronics in Princeton, N.J. It is an honor and privilege to have this opportunity to express our position and reaction toward the commercialization of the U.S. land remote sensing system to this committee.

Through our Astro-Electronics division, we have a long history with low-altitude, polar orbiting spacecraft, and by virtue of that position, through being the contractor for the TIROS and the DMSP meterological satellite programs.

We are an avid supporter of the commercialization of space when such ventures meet the criteria of supporting a legitimate and reasonable return to the investor, without perpetual Government subsidy, and when such commercialization in no way is detrimental to the safety and welfare of the public interest or national security.

We think the Landsat system appears to meet these standards, and is therefore a logical candidate for commercialization. We have supported the activity of both the House and Senate that would authorize and define the commercialization, and have recently demonstrated that support, as Mr. Bishop has announced, by establishing through a joint venture with Hughes, a separate entity called Eosat, with major subcontractors being Computer Science Corp. and Earthsat.

The path to obtaining a fair return on the investments we envisage for this venture does have considerable and attendant risks. Our several independent market revenue projections were significantly different, and this is not surprising when one compares the present revenues with the value required to sustain a mature commercialized operation.

There is little question that the ultimate success of this enterprise is critically coupled to the efficiency with which the market for these sales has developed and the continuity of that data in the initial phases of the commercialization.

Final necessities are really dependent on the Government's activities, and they consist of the timeliness of this legislation and the fact that this legislation ends up to be conducive to commercial needs and practices.

The Senate is to be complimented on the rapid progress to date from the submission of the Senator Hollings bill to the introduction by Senator Gorton of the presently proposed legislation last month.

Yet, the crucial issue at this point is still time, and the most important objective is to provide a final bill that will be acceptable to both congressional bodies in the minimum amount of time, so that we can avoid any iterations of the RFP process or ensuing negotiations.

Our examination and evaluation of the proposed bill prompts us to call attention to certain conditions that are contained therein, which we feel should be modified to provide true commercial principles in areas of titles, tax statutes, and contractor rights to the extent possible, always commensurate with the public safety and national security.

We believe Government support is required to transition this system to the eventually desired privatized enterprise. This is especially true in light of the R&D nature of the present system and the intense competition that the U.S. contractor will encounter from heavily subsidized foreign competitors entering the same arena.

We believe the allusion to such support and cooperation in the Senate bill is somewhat vague and conceptually insufficient with respect to our evaluation of market projections.

My company is a staunch supporter of NASA in the development, application, and demonstration of space technology. We believe it should continue in all remote sensing disciplines, including land and oceans, and the legislation should make it entirely clear that remote sensing includes not only land, but also ocean remote sensing.

[The statement follows:]

STATEMENT OF CHARLES A. SCHMIDT, VICE PRESIDENT AND GENERAL MANAGER, RCA ASTRO-ELECTRONICS

Mr. Chairman and Distinguished Members of the Subcommittee, my name is Charles Schmidt. I am the Vice President and General Manager of RCA Astro-Electronics in Princeton, New Jersey.

It is an honor and a privilege to have this opportunity to express for RCA our position and reaction toward the commercialization of the U.S. land remote sensing system to this committee.

RCA, through its Astro-Electronics division, has a long history with low altitude, polar orbiting spacecraft by virtue of our position as the contractor for the TIROS and DMSP meteorological satellite programs.

With this important segment of our business and RCA's position as a major supplier and operator of commercial communication satellites, we have a significant interest in commercial space ventures and the new markets that may be developed from the expanding opportunties.

RCA is an avid supporter of the commercialization of space when such ventures meet the necessary criteria of (1) an ability to support a legitimate business with a reasonable return to investors without perpetual government subsidy and (2) when such commercialization is not detrimental to the public safety and welfare or National Security interests. The Landsat System appears to meet these standards and its therefore a logical candidate for commercialization.

RCA has supported the activity of both the House and Senate that would authorize and define the Landsat commercialization and have recently demonstrated that support by establishing, through joint venture with Hughes Santa Barbara Research Center, a separate entity called EOSAT, for the purpose of submitting a proposal on March 19th to complete for the Department of Commerce award of the Landsat commercialization program.

The resources required to address this program comprehensively are considerable. They require investment commitments, existing appllicable technology, broad technical expertise and demonstrable background in sensor technology, spacecraft design, software design, ground system operational experience and an intimate knowledge of the market that must be developed from its present embryonic status to the robust business base required to profitably support the ongoing capital investment and labor base of mature commercial land remote sensing enterprise.

Fortunately, EOSAT's team is ideally structured to execute those considerable tasks. Beside the principal partners comprising EOSAT, we have contracted with Computer Science Corporation and Earth Satellite Corporation to complete the skill and experience inventory essential to credibility and commercial success.

These factors notwithstanding, the path to attaining a fair return on investment for this venture has considerable attendant risks. Our several independent market revenue projections were significantly different. This is not surprising when one compares the present revenues with the value required to sustain a mature commercialized operation.

There is little question that the ultimate success of this enterprise is critically coupled to the efficiency with which the market for data sales is developed and the continuity of that data in the initial phase of commercial transition.

To accomplish that development, the U.S. contractor must design and implement: A single location ground segment that is focused on operational efficiency and commercial procedure and practice, and a space segment that meets all of the present requirements in data quality and quantity, while providing an evolutionary scenario for sensor technology, is imperative. This capitalizes on existing R&D investments to implement, via the Multi-Spectral Scanner and Thematic Mapper, a competitive data product for the near term market. The next step is to progress into the superior high market value data product of the Multi-Linear Array with Short Wave Infra-Red capability.

The maintenance of data continuity and high performance ground and space hardware are, as stated, necessary ingredients toward private venture success, but once in place sufficiency is absolutely dependent on the skill and expertise of an aggresive marketing organization and plan that identifies potential users throughout the world educates that community to the specific benefits of the product, assists in the establishment and growth of value added participants and finally caters to the customers needs to transition his activity from marketing to sales.

Employing these strategies and tactics we envision the risk of perceived opportunity transforming into a self-supporting business without perennial Government support.

The final necessities to assure the desired objectives are dependent on the Government, they consist of: (1) timeliness and (2) enabling legislation conducive to commercial needs and practices.

The Senate is to be complimented on the rapid progress made to date leading to the introduction by Senator Gorton of the proposed legislation last month.

Yet, the crucial issue at this point is still time and the most important objective is to provide a final bill acceptable to both Congressional bodies in a minimum amount of time to ensure that the DOC selection process is consistent with your legislation, therefore avoiding any repetition or delay of the selection and/or negotiation process.

Using realistic instrument and spacecraft production schedules, based on experience and a competent assessment of what is required, one moves readily to the conclusion that it is imperative that the Government move expeditiously to minimize the gap which will result after the demise of LANDSAT 5 (which has now been launched).

A several months delay from the published schedule would seriously jeopardize the already slim prospect of data continuity and delay of more than a year would virtually eliminate it.

We hasten to point out that a gap in data is not merely of academic interest because it would occur at the time when competition from foreign systems is becoming most intense, and this gap could cause a shift of the customer base away from the U.S. system to alternates.

This is precisely what the U.S. operator cannot afford if he is to become commercially viable.

Our examination and evaluation of the proposed Bill prompts us to call attention to certain conditions contained therein which we feel should be modified to permit true commercial principles, titles, tax statutes and rights to the extent possible, commensurate with the public safety and National Security.

We believe Government support is required to transition the present system to the eventually desired privatized business enterprise. This is especially true in light of the R&D nature of the present system and the intense competition the U.S. contractor will encounter from heavily subsidized foreign competitors entering this arena. We believe the allusion to such support and cooperation in the Senate Bill is somewhat vague and conceptually insufficient with respect to our evaluation of market projections.

My company is a staunch supporter of NASA in the development, application and demonstration of space technology, and we believe it should continue in all remote sensing disciplines, including Land and Oceans. Legislation should make it entirely clear that remote sensing includes not only land but also ocean remote sensing.

We do not, however, believe that the sale of data products from such research and development should in anyway take on the aspects of competition with the Government's designated Land and/or Ocean private operator under the thrust of this bill. This seems inconsistent with much of the rest of this program's intent. As a very minimum, the commercial venture should be granted the right of first refusal prior to Government sale. Also to the extent legislation addresses the sale of data from observational and monitoring efforts of NOAA and NASA, such data should be sold, if at all, en bloc, and those agencies should not compete with the private entity in the sale of such data.

There are a number of other matters which we believe that legislation should clearly cover and which are addressed in the following recommendations.

Successful commercialization is absolutely dependent on necessary Governmental authorizations. Accordingly, the FCC should be directed (not simply encouraged or authorized) to issue the necessary construction permits and licenses and to allocate the appropriate radio frequencies for use by commercial remote-sensing satellite operations.

Of paramount importance to the private operator is its rights in the Landsat data. It should be able to impose conditions on sale to protect against dilution of the market from either reproductions or dissemination for uses that would normally occasion a separate sale. While to a large degree the Bill seems to authorize the imposition of such conditions, we think it necessary to emphasize the point since there are ambiguities created by the provision in Section 201 that NOAA retains ownership of unenhanced data and Section 603 which authorizes sale on condition that the data not be reproduced *and* disseminated but does not authorize a sale on condition that the data only not be reproduced. Also, the private operator should have the exclusive right for an appropriate period to sell data maintained in the remote sensing data archive.

It should be understood that sale on a "non-discriminatory basis" shall not require the private entity to expend equal efforts to develop all segments of a market. The market will have a number of segments and the Contractor should have the latitude to develop them appropriately.

The definition of the Landsat System should include not only Landsat 4 and 5 but also successor systems launched by the United States prior to the provision of remote sensing capabilities by a private contractor. To the extent that the Landsat

System is enhanced by additions, as is certainly intended, the rights and obligations of the Government and operator should continue as is recommended herein.

For purposes of consistency the legislation should require the Contractor to "offer and sell" on a non-discriminatory basis. The proposed legislation uses the phrase "make available" where the former term should be used.

With respect to Sections 202(a)(2) and (3) of the Bill relating to payment to the Government by the Contractor for unenhanced data, these Sections seem at odds with the Government intent to effect commercialization on a sound economic basis.

The contractor should have the right to buy or acquire use of Landsat equipment when it is no longer needed for operation of or sale of data from the Landsat System.

Finally, while not within the scope of this Bill, legislation should be enacted to provide that a system owned by a private entity shall be eligible for investment tax credits and for depreciation under the accelerated cost recovery system. Commercial communications satellites are accorded this treatment so it is only equitable that a private Landsat system be given similar status.

Mr. Chairman, I have attempted in this testimony to provide a fair account of our activities and opinions on the commercialization of Land and Ocean remote sensing.

I believe the efforts of Congress in this matter have been considerable and are requisite to establish much needed Federal guidelines. If I can be of any additional assistance, I am at your service.

The EOSAT joint venture and each of its team members are dedicated to your proposition to maintain the United States as the undisputed world leader in remote sensing technology.

This concludes my prepared statement.

Thank you.

Senator GORTON. Thank you, Mr. Schmidt.

Mr. Sinkewiz.

Mr. SINKEWIZ. Thank you.

My name is Giles Sinkewiz. I am general manager of Spacecraft Operations, General Electric, and I welcome this opportunity to appear before you today on behalf of Allan J. Rosenberg, vice president and general manager of Space Systems Division.

I will try and hold my remarks to be very brief.

Regarding the General Electric position on commercialization, we did not respond to the request for proposal for transfer of land remote sensing program to the private sector. This was a difficult decision for us, since we have been an advocate of the Landsat program from its inception. We have a vital interest in the growth and progress of this program.

However, we are seriously concerned about proposed plans for the program's transition from Government sponsorship to the private sector.

In our review of the RFP, we asked ourselves a basic question: Does the RFP process and our in-depth understanding of the remote sensing program provide a workable framework which could result in a commercially viable system? Our conclusion was it did not.

The RFP requires the private sector to assume full responsibility for all the aspects of remote sensing, including the commitment for followon satellites before a sufficient level of market development has been demonstrated.

In our view, the market potential would not provide a reasonable return sufficient to cover ongoing operating expenses and amortization of investment, and the venture would fail without substantial Government subsidy.

The prudent business decision for GE was to decline to bid. In our view, the key issues facing the land remote sensing program are data continuity and the timing of commercialization. At the recent Landsat user symposium, held on February 27, and attended by more than 250 representatives from the remote sensing community, concern for continuity was, in fact, a common theme. General Electric has been in the forefront of this discussion of continuity since 1981, when Mr. Rosenberg testified before a joint committee.

We have consistently pointed to the need for timely decisions to ensure the availability of data acquisition capability beyond Landsat 5. I am pleased to note that Landsat 5 is in operation in orbit.

As confident as we are of achieving nominal mission life, it is alarming to know that there is neither backup satellite available, nor a plan. A data gap may well be in the making. We are on the threshold of establishing an operational system capability. However, the U.S. Government has no plans to capitalize on either the world leadership position, nor the achieved significant investment to date.

Landsat continuity decisions by the administration have been preempted by the commercialization effort.

Central to the continuity discussion is the question of appropriate timing of commercialization. General Electric and others have testified over the past several years that premature commercialization could result in complete loss of this vital technology which has been developed. Studies have indicated that it could cost the Federal Government as much to subsidize a private venture as it would cost to continue Government operation of the system, and that users believe that cost of Landsat data would increase under private operation, resulting in curtailing or even stopping use of Landsat data.

Assurance of data continuity allows time for the potential market to be understood and developed. After a sufficient period during which a valid assessment of market potential can be conducted, the Government can address the issue of total commercialization.

A more realistic approach requires an immediate commitment by the Federal Government with the objective of assuring data continuity. One approach is a commitment to Landsat D″ with the immediate procurement of long lead parts a necessity. A 4-year fabrication plan would provide a satellite in early 1988, minimizing the potential data gap.

Another alternative which is currently under study is a possibility of a Landsat 4 on-orbit repair mission. This approach has added features of lower cost and earlier availability of data with, of course, some attendant risk.

During the past several months, General Electric has conducted a feasibility analysis into the use of a space shuttle to accomplish a repair mission of Landsat 4. The results of this analysis are now being completed, and it appears that it is feasible.

By taking advantage of the existing satellite and——

Senator GORTON. Excuse me, Mr. Sinkewiz. Could you summarize the balance of your testimony?

Mr. SINKEWIZ. Yes.

In conclusion, Mr. Chairman, prudent and good business judgment dictates that we carefully consider the assurance of data continuity and a systematic approach to market development as a necessary and valuable preparation for any future transition to commercial ownership and operation.

[The statement follows:]

STATEMENT OF ALLAN J. ROSENBERG, VICE PRESIDENT, GENERAL ELECTRIC CO., GENERAL MANAGER, SPACE SYSTEMS DIVISION

INTRODUCTION

I welcome this opportunity to offer some observations regarding the potential commercialization of the civil land remote sensing program. I am particularly pleased to share these thoughts before a Congressional body which has been so instrumental in making the Landsat program a national asset of global dimension and significance. I also commend you, Mr. Chairman, and your colleagues for taking the initiative to remove the weather satellites from consideration, and focusing attention on the critical issues facing the land remote sensing program.

In my remarks today, I will address four topics:

1. The General Electric Company's position regarding transfer of the civil land remote sensing program to the private sector;
2. The company's views on key issues facing the land remote sensing program;
3. Comments on legislation introduced to facilitate private sector involvement; and
4. Recommended approaches to achieve Landsat data continuity, including consideration of a Landsat 4 on-orbit repair mission.

THE GENERAL ELECTRIC POSITION ON COMMERCIALIZATION

The General Electric Company did not respond to the Request for Proposal for Transfer of the Land Remote Sensing Program to the Private Sector. This was a difficult decision for us since we have been an advocate of the Landsat program from its inception as a working partner with NASA, NOAA and other groups, public and private. As a participant in all program phases—design, development, operation and applications—a day-to-day, hands-on involvement totaling more than 15 years, we have a vital interest in the further growth and progress of the program. However, we are seriously concerned about proposed plans for the program's transition from government sponsorship to a private sector enterprise.

In our review of the RFP, we asked ourselves a basic question—Does the RFP process and our own in-depth understanding of the land remote sensing program provide a workable framework which could result in a commercially viable system? Our conclusion was it did not.

The RFP requires the private sector to assume full responsibility for all aspects of remote sensing, including the commitment to follow-on satellites before a sufficient level of market development has been demonstrated. In our view, the market potential would not provide a reasonable return sufficient to cover on-going operating costs and amortization of investment, and the venture would fail without substantial government subsidy. Such a subsidy suggested in the RFP certainly would not constitute commercialization in the sense that the government intended when it initiated this activity. The prudent business decision for GE was to decline to bid.

THE KEY ISSUES IN LAND REMOTE SENSING

Many studies have been conducted and reports published on commercialization. The most recent of these reports, "Remote Sensing and the Private Sector, Issues for Discussion, A Technical Memorandum, March, 1984" prepared by the Office of Technology Assessment, provides an excellent summary. Another report, "Effects on Users of Commercializing Landsat and the Weather Satellites," released by the Comptroller General in February, 1984, is also worthy of mention. While many issues were raised in these reports, I would like to concentrate now on the issues of data continuity and the timing of commercialization.

Data continuity

Both reports point out that Landsat data has significant value, providing public and private benefits on a worldwide basis for a variety of users and applications areas. As a government sponsored program over the past decade, Landsat has supported all users on a non-discriminatory basis and the Landsat system has been gradually improved to serve users with quality data on a timely basis. The user community is genuinely concerned about the future course of the program, particularly the issue of Landsat data continuity. At the recent Landsat User Symposium, held during the week of February 27, 1984, and attended by more than 250 representatives from the remote sensing community, concern over data continuity was a common theme.

General Electric has been in the forefront of the discussion on the continuity issue, as far back as July 23, 1981, when I testified at a joint Senate and House Subcommittee hearing. We have consistently pointed to the need for timely decisions to ensure the availability of data acquisition capability beyond Landsat 5. I am pleased to note that Landsat 5 was successfully launched on March 1, 1984, and is working satisfactorily on orbit. MultiSpectral Scanner (MSS) data is already being utilized on an operational basis. At the completion of its development phase in January, 1985, the Thematic Mapper (TM) will be turned over to NOAA for operational use. Supported by a global TDRSS capability and an expanded set of foreign direct readout ground stations, the foundation will be in place for an operational Landsat System capable of delivering improved data products and services to users on a routine quick-turnaround basis through early 1987. As confident as we are of achieving nominal mission life, it is alarming to know that there is neither a backup satellite available, nor planned. A data gap may be in the making.

At the very moment that we are on the threshhold of this important operational capability, the U.S. Government has no plans to capitalize on either the world leadership position it has achieved or its significant investment of date. Landsat continuity decisions by the Administration, including Secretary Baldrige's initiative on long lead parts for Landsat D", have been precluded by the commericialization process. Also, in the RFP, the Administration does not require a bidder to take over the existing system but merely encourages bidders to do so.

The wordwide user community is justifiably concerned over the lack of U.S. commitment to Landsat. Consequently, current and potential users may well turn to foreign sources for comparable data, and it is not inconceivable that the most prominent users of Landsat data—agencies of the Federal Government—could be placed in the untenable position of relying on foreign sources for important global earth resources data.

Central to the continuity discussion is the question of the appropriate timing of commericialization of the civil land remote sensing program.

Timing of commercialization

General Electric and others have testified over the past several years that commercialization is premature without a thorough understanding of the market which is necessary to sustain such a venture. Concerns have been raised that premature commercialization could result in complete loss of this vital technology which has been so painstakingly developed. Studies have pointed out the economic considerations and demonstrate, almost unanimously, the need for a subsidy. The OTA study, referenced earlier, concluded ". . .Until the market expands substantially, and more efficient spacecraft are developed and deployed, it could cost the Federal Government as much to subsidize a private owner as to continue operating the system itself". In our opinion, the subsidization of a new venture would probably be greater than current costs.

The Comptroller General report, referenced earlier, also took note of this fact, and I quote ". . . Most of the federal Landsat users believed that the cost of Landsat data would probably increase under private operation, and almost all believed that increases would cause them to curtail or even stop using Landsat data . . . The only potential benefit which was mentioned by more than two users was that a private owner would probably improve the marketing of Landsat data". Market development has been identified as a major issue and I believe that market development can be undertaken independent of total commercialization and that data continuity is a necessary adjunct to enable it to take place.

Thus, our first priority should be assurance of data continuity to ensure that demonstrated benefits and program momentum are not lost. While this approach leaves the higher risk and higher cost data acquisition function within the government, it does allow emphasis to be placed on delivering data products, services and information to users in a cost-effective manner. Further, it allows time for the potential market to be understood and developed, and enables the entreprenurial spirit of U.S. industry to focus its investment in a potential business area (i.e., data processing and information services) which is more consistent with normal business risk and reward tradeoffs. After a sufficient period, during which a valid assessment of the market potential can be conducted, the government can address the issue of total commercialization more confidently, hopefully without the need for any subsidies.

Further, we endorse NASA's intention to continue to develop the next generation of earth resources sensors and spacecraft capabilities which will maintain our technology leadership in the face of foreign competition.

COMMENTS ON REMOTE SENSING LEGISLATION

I would like to comment on several aspects of the legislation recently introduced both in the Senate (Bill S.2292) and the House (Bill H.R. 4836). The two Bills are similar in many respects. We provided comments to the House in November on their initial draft legislation, and a copy of these earlier comments were provided to your staff.

The objective of Title II is the initiation of market development activity in advance of the Title III operator bringing a continuity satellite system on line. The key concern about Title II is that the anticipated Title III continuity capability would result in only MSS level data, since that's what the government would subsidize per the RFP and the House legislation. Once the Title III approach is selected, and assuming it is MSS (or at least not TM), the availability of TM data, on an operational basis to serve user needs, becomes moot. The foreign subsidized competition offers higher resolution and features, such as stereo, which would have a significant adverse impact on the ability of the Title II operator to develop a market for the sale of Landsat data.

Having progressed from MSS to TM over the past decade, our government should not regress to a lower level of capability, especially when the TM is proving to have significant advantages over MSS-level data. General Electric, with NASA and NOAA support, has recently developed a new Landsat applications brochure, copies of which have been made available to your subcommittee. This brochure highlights the demonstrated improvements in both data acquisition and data analysis capability afforded by the current Landsat system and the Thematic Mapper sensor, as compared to earlier Multi-Spectral Scanner data. Significant improvement in the ability to discriminate and classify earth resources data will result in an expanded set of applications and act as a stimulus to the utilization of Landsat TM data. The TM, SPOT and MOMS sensor data sets should define the market from 1985 on. If there is little or no market for MSS data in the late 1980's, then an MSS-based venture will fail, or the government will have to provide additional subsidies beyond the intended one time infusion.

Also, MSS does not provide technology leadership in the face of foreign advancements. Since it is the same 80-meter visible channel data, it cannot contribute to market expansion in the form of new applications as TM can. If the government anticipates that the private sector operator will fly a sensor with capabilities beyond the MSS at its own cost, the same questions arise about the lack of a demonstrated market during an early competition.

Therefore, we fully support the January, 1984 recommendation of the Halbouty Civil Operational Remote Sensing Satellite Advisory Committee (CORSSAC) to Secretary Baldrige, and I quote, ". . . no commercial satellite system will succeed unless it provides data commercially competitive in the world marketplace, . . . the government must ensure that there is no interruption in acquisition, distribution and archiving of, at a minimum 'TM-like' data. In this regard, whether commercialization is achieved or not, it is vital to the national interest that TM-like data be continuously acquired until better systems are developed."

Title III also calls for a report to the Congress on the feasibility of the private sector taking over full ownership and operation two years after initiating the data continuity service. This report would be available about 1990 (based on nominal assumptions for contract initiation, satellite fabrication and launch). Thus, approximately six years after enactment of the legislation, the Congress *may* find out that commercialization (at least on this basis) won't work and all of the interim time and opportunity will have been lost.

RECOMMENDED APPROACHES TO ASSURE LANDSAT DATA CONTINUITY

A more realistic approach requires an immediate commitment, by the Federal Government, to Landsat TM data continuity with the objectives of assuring data continuity with a minimum data gap, maintaining technology leadership and user support, and enhancing market development.

Data continuity approaches

Continuity can be achieved in several ways:

1. One approach which has been discussed for some time and is obviously the most risk-free, is a commitment to Landsat D'', with immediate procurement of long

lead parts a necessity. A nominal four-year fabrication plan would provide a continuity satellite in early 1988, minimizing the potential data gap beyond the nominal end of Landsat 5 operations.

2. Another alternative which is currently under study is the possibility of a Landsat 4 on-orbit repair mission. This approach has the added features of lower cost, earlier availability of continuity capability and further demonstration of shuttle on-orbit capabilities, with, of course, some technical risk.

Landsat 4 repair mission

During the past several months, General Electric has conducted an initial feasibility analysis into the use of the Space Shuttle to accomplish a repair mission of the Landsat 4 spacecraft. The results of this analysis are now being completed and documented; they should be available within the next month. At this point in our study, it appears that the Landsat 4 spacecraft can be successfully repaired while still in orbit by using the Space Shuttle astronauts to correct the failed items. The techniques being developed and demonstrated by NASA, together with the technical analysis we have done, appear to result in a feasible mission with a reasonably high chance of success.

In brief, the mission we are suggesting would occur in early 1986 and would involve the Space Shuttle orbiter Discovery launched from the Western Test Range. The major elements of the mission would be to deorbit Landsat 4 to a lower orbit compatible with the Shuttle's capability; rendezvous orbiter with the spacecraft and capture it into the payload bay; replace each of the failed items with replacement units using special tools during an astronaut extra-vehicular activity (EVA); and refuel the spacecraft with additional propellant and test it to ensure that the repairs were successful. Following successful repairs, the spacecraft will be returned to its operational altitude and should be capable of operations for an additional three years. If the repairs are not successful, then the spacecraft could be returned to Earth as a retrieval mission for refurbishment if desired.

We have analyzed each of these major steps and are finding that all necessary tasks appear to be feasible. Of course, additional analysis, planning, and development is required. However, in order to meet the various timing constraints, an initial mission go-ahead decision must be made very soon concurrent with the continuation of mission risk analysis.

The on-orbit repair of Landsat 4 offers a major cost advantage in recapturing and putting into productive use the considerable investment already made in this spacecraft. Most of the spacecraft subsystems are still fully operational and capable of several more years of operational use. The spacecraft is already on-orbit, thus avoiding additional launch costs, and the ground system is already capable of handling this spacecraft without modifications. Previous NASA cost analyses have shown the repair mission to be highly cost-effective when compared to alternative approaches of maintaining Landsat data continuity. The repair of Landsat 4 will provide for needed data continuity into 1990. By taking advantage of the existing satellite, the already operational ground segment, and the in-place support and policy infrastructure, the overall cost of achieving continuity will be relatively low. In fact, it should be considerably less than the subsidized approaches to the proposed commercialization. Our initial analysis indicates that a Space Shuttle on-orbit repair mission for Landsat 4 is an attractive option and we recommend that it be seriously considered. Thus, with continuity assured into the 1990 timeframe either through a Landsat D" or a repair mission, the government can initiate competitive actions to bring private sector experience to bear on market development.

Market development

A licensee (or licensees) would assume responsibility for market development for Landsat data products and services in an operational environment. The existing Landsat ground segment data management system assets could be offered competitively for a consideration if this were desired. In this approach, a market developer has a stake in the outcome. There is something to sell (i.e., TM data), reasonable assurance that the product and service can be delivered and the opportunity to reap the benefits of the market developed over a longer period of time. After a reasonable period of market development, especially in the face of foreign competition, the Congress can assess the market potential in the late 80's time frame and still have sufficient lead time to make follow-on satellite procurement decisions, including potential for private sector involvement, for the long-term land remote sensing program.

CONCLUSION

Mr. Chairman, prudence and good business judgement dictate that we carefully consider the present course of the Landsat program, and think in terms of the long-term payoff so that we do not jeopardize either the investment to date or the interests of the user community. The assurance of data continuity and a systematic approach to market development will be necessary and valuable preparations for any future transition to full commercial ownership and operation.

I hope that my comments and recommendations will be of value in the continuation of your subcommittee's initiative and interest in a viable civil land remote sensing program.

Senator **Gorton**. Thank you.

Ms. Josephson.

Ms. **Josephson**. I want to thank you for your kind invitation to present testimony today. I am representing Space America, Inc. Our original three investing companies are being joined by the Bendix Field Engineering Corp., a unit of Allied Corp., which has agreed to buy 20 percent of our stock if Space America is awarded a contract under the RFP.

We submitted our bid on Monday to the Department of Commerce. I will try to be as forthcoming as possible without disclosing the specifics of our bid that are proprietary in nature.

We have two general areas of concern about the bill. First is the fact that the legislative process is running parallel to the RFP process, rather than preceding it. This places companies such as ours and the other bidders in a difficult position, since we must obtain congressional guidance from pending legislation, rather than an enacted law.

Our first request is that the rules of the game not be changed after the RFP's closing date.

Our second concern has to do with the timing of the legislation. We would like to strongly urge that the Senate act quickly on the bill in order to insure the prompt resolution of Landsat commercialization issues during this session of Congress.

We stand ready to proceed with our system on September 1, 1984, and would like to be able to proceed, rather than continue with the political process.

Our other areas of concern deal more specifically with the bill. I was pleased to learn from your opening statement that you plan to change the baseline of the bill away from TM data being the baseline. I wanted to speak briefly to that issue.

Our belief is that the market at this time justifies 80 meter resolution. We have conducted market surveys which indicate this is the fact. We also have discussed resolution with Federal users, and non-Federal users. Our position is borne out by the OTA study which has just been released, which indicates that, in its view, 80 meters technology is just ready to become operational. The TM data, in our view, are still experimental. It is much more costly to use these data. It takes large data processing equipment; it requires more tapes, it takes more time.

In addition, the satellite system required to produce such data is much more costly due to the large sensor required.

As a system operator, therefore, you end up with some tradesoffs. You can either charge users high prices in order to cover the higher cost of the system, which means you end up with fewer users which is not very productive for a commercial system, or you have to ask for a higher subsidy from the Government in order to pay the larger initial costs, which again delays the achievement of full commercialization which is the purpose of this exercise.

At this time, the high resolution market is mostly in nonrenewable resources which is a one-time market. The geological and the cartography communities like to get worldwide coverage. They then spend many years studying these data until another system comes along which offers them different information.

The renewable resource market is essentially not operational. The biggest issue there is timeliness, not resolution. In other words, if I am the manager of a large agricultural resource, I need to have the data today and not 2 weeks from now if I am to be able to use it effectively.

The second issue for renewable resource users is cost. Since they require frequent repeat coverage, they are concerned that the cost of the data not make it impossible for them to purchase.

We believe that an extensive marketing program can lead to an expanded market for high resolution data, that hopefully will cover the costs of such a system. But we also believe the timing of the decision to move to such a system should be market-driven, and not required now by legislation.

The administration and the House have recognized this. Both the RFP and the House bill support 80-meter resolution as a baseline, and we urge that the Senate bill reflect this same standard and not TM's 30-meter resolution.

There is another issue with respect to TM. When TM is used as a word, there are essentially three issues which it covers: Resolution, bands, and technology. Often these are used interchangeably, without differentiating which word is intended. If we take, for example, the two new shortwave infrared bands, which are of great interest to the geological community, our belief is that the demand for those bands will essentially be satisfied by Landsat 5.

If we look at how many scenes can be acquired, there are essentially 12,000 scenes worldwide, of which 6,000 the Geosat Committee and its members are telling us are a priority to geological users. The Landsat 5 system can process 50 scenes a day, so that 55,000 scenes will have been processed during the life of Landsat 5, which will more than cover——

Senator **Gorton**. Can we get you to summarize your testimony?

Ms. **Josephson**. Yes.

In conclusion, we would urge that the baseline of the bill be the 80-meter resolution and that the bill's evaluation criteria include a standard of commercial viability.

Thank you.

[The statement follows:]

STATEMENT OF DIANA H. JOSEPHSON, PRESIDENT, SPACE AMERICA, INC.

Chairman Gorton, members of the subcommittee, thank you for your kind invitation to present testimony. I am Diana H. Josephson, president of Space America, Inc., a corporation that is the legal successor to our joint venture, known as "Space America". Three companies, Space Services Incorporated of America, the American Science and Technology Corporation, and the Aeros Data Corporation were the members of this joint venture and are the incorporating shareholders of the new corporation.

Space America, Inc., has submitted a proposal to the Department of Commerce this past Monday in response to the request for proposals for transfer of the United States land remote sensing program to the private sector (RFP). I will be as forthcoming as possible about the Space America proposal, without disclosing those specifics of our bid that are proprietary in nature. Space America is aware of the intense interest of members of the Senate and House in this issue and in our proposal, and would welcome an opportunity to discuss these issues with you individually on an off-the-record basis.

Let me say first that, where S. 2292 and H.R. 4836 reflect major congressional concerns, we have tried to avail ourselves of the RFP's flexibility in order to satisfy important legislative requirements. Among these concerns, is the "open skies" policy, which we intend to adhere to.

However, the fact that the legislative process is running parallel to the RFP process, rather than preceding it, places companies such as ours in a difficult position. No authorization for the RFP process has been enacted into law, so we must obtain congressional guidance from pending legislation and hope that the "rules of the game" are not changed after the RFP's closing date.

We feel strongly that since we, along with other industry groups, have expended substantial resources on responding to the RFP, it would be helpful if S. 2292 were made consistent with the RFP and with H.R. 4836 on certain points that are noncontroversial. For instance, we have noted that the selection criteria set forth in your bill differ somewhat from those in the RFP and H.R. 4836.

We also strongly urge that the Senate act quickly on S. 2292 in order to ensure the prompt resolution of Landsat commercialization issues during this session of the Congress. Space America, Inc. is a new entity, but the companies owning Space America's stock have been expending resources for three years on the commercial development of land remote sensing from space. We need Congress to enact a law that will allow an award under the RFP, so that we can avoid the additional expense of further delays, maintain the U.S. competitive edge over foreign satellite programs, solve the data gap problem, and ensure a continuing U.S. data capability.

We believe that our land remote sensing program will both compete successfully for the nascent worldwide market and maintain the U.S. lead in the current market. Many of the existing foreign ground stations already have indicated a desire to purchase Space America data. Other customers, who are identified in the marketing segment of our proposal, also have expressed interest in obtaining Space America data. A protracted debate on the issues surrounding land remote sensing commercialization will serve only to encourage foreign competitors to negate our marketing efforts. As Chairman Fuqua stated upon introduction of H.R. 4846, "The time has arrived for the Congress and the administration to resolve the issue of commercialization of land remote sensing. * * * It is important that we reach a consensus on this issue quickly, in order that the United States not hand over to foreign competitors another technology that is ripe for commercialization." We urge you to consider seriously our request for expedited action.

Let me describe our program briefly. We plan to provide the first commercial U.S. land remote sensing satellite system, using low-cost "state-of-the-art" spacecraft, sensors, launch vehicles, and computer technology. We formulated our sensor design in response to discussions with customers about their data needs. We believe the follow-on to Landsat 5 should be a commercial, operational, market-driven system, one that requires a short lead time.

Ball Aerospace Systems division will be the spacecraft contractor; Honeywell's electro-optics division will build the sensors; and Bendix Field Engineering Corporation will build and operate the ground system. Their participation has confirmed our belief that we have technically reliable, cost-effective system.

The Space America spacecraft is compatible with both the Conestoga launch vehicle developed by SSI, as well as NASA's space shuttle. Space America is subcontracting with SSI for a Conestoga III and has requested information from NASA about possible shuttle launch dates. Both launch vehicle options are available.

In addition to its space segment, Space America is developing a next-generation data processing software system, the combined environmental/economic data and information system (CEDIS). CEDIS will combine satellite, aircraft, and conventional data to produce new information products for users worldwide. CEDIS will take advantage of the advances in computer and other technologies that are occurring with increasing rapidity. To meet congressional concerns, Space America will maintain its value-added activities as a separate financial center on an equal basis with other value-added companies. We are pursuing all possible options to expand the market for land remote sensing data and information products, so it is in our best interest to assure all potential customers that they will be treated equally.

The Space America program is designed to meet the demands of data customers worldwide, such as the Federal agencies, U.S. industry, the academic community, foreign ground stations, foreign governments and industry, and the international community. The system will expand existing markets by providing stereoscopic data in near-real time and at prices which will encourage many additional customers worldwide to use the data. Our market surveys have convinced us that there is a large and growing market for both raw data and next-generation information/planning products. Of course our marketing division will abide by all antitrust stipulations and nondiscriminatory access provisions of S. 2292

We believe that the Space America approach of cost-effective, market-oriented, commercial land remote sensing from space will become a reality with your help.

BILL COMMENTS

Turning now to the specific legislation pending before you, I would first like to say that we are extremely pleased to have the opportunity to testify in support of S. 2292, the Senate counterpart to H.R. 4836, and are encouraged to see both Houses of Congress working to facilitate the development of a U.S. land remote sensing satellite industry. Both bills provide an appropriate balance between the financial interests of the potential private operators and the concerns of international, Federal, and non-Federal users. We support both bills and the transitional approach to commercialization that they would authorize.

During the past year, the House Committee on Science and Technology has help a series of hearings on the satellite commercialization issue. These discussions, followed by a period of industry review and comment, led to the introduction of H.R. 4836, which resolves the controversial issues surrounding commercialization, ensures that any potential negative impact of commercialization are avoided, and authorizes the RFP process. As you are aware, this bill is scheduled to be reported out of committee today.

Two recent congressionally requested reports, OTA's "Remote Sensing and the Private Sector" and GAO's "The Effects on Users of Commercializing Landsat and the Weather Satellites," point out some of the issues that needed to be resolved prior to a decision on Landsat commercialization. We believe that H.R. 4836 and S. 2292 ensure that the potential problems identified in these reports will not occur. Their various provisions, particularly those providing for Government oversight, will ensure that: National security concerns and international commitments are met; data continue to be distributed on an open and non-discriminatory basis; university and Government research programs continue to maintain U.S. leadership in this field; and foreign, governmental, and private sector customers, including the value-added industry, are protected from unfair prices and practices.

We have two major comments of S.2292, "The Land Remote Sensing Satellite Communications (Commercialization) Act of 1984," and will submit our more detailed comments for the record.

First, we have reviewed the bill's definition of the U.S. Government's base-line data requirement contained in section 303(a)(1), and have concluded that the evaluation criteria will penalize a proposal that does not provide both thematic mapper TM resolution and bands.

With respect to resolution, the TM is still an experimental system. Since customers have had only limited access to 30 meter resolution data, the market is as yet undeveloped. Customers worldwide have not yet invested in the computing capacity required to handle data rates of 86 MBPS, as opposed to 15 MBPS. Let me highlight the difference. One TM scene requires seven computer compatible tapes, as opposed to one computer compatible tape for an MSS scene. Customer computing capability must be scaled up accordingly, as must the computer time required to process the data. We believe that we can develop a sufficient high resolution market to justify the large additional costs of such a system, both to customers and to ourselves, but that the timing of this decision should be market-driven and not prescribed in the legislation.

With respect to band selection, we believe that whatever market exists for the TM's short wave infrared bands will have been saturated by the end of Landsat 5's useful life. Further provision of these identical bands cannot therefore be justified on a commercial basis.

Finally, the bill's selection criteria do not include a "commercial viability" evaluation factor. We believe that this omission, taken in conjunction with a data baseline measurement that is experimental, not operational, establishes a technology driven rather than a market-driven baseline.

The RFP and the House Bill assume that current operational data are the baseline. Our data will be "functionally equivalent to data from the multi-spectral scanner" and "fully compatible with data, and equipment used to process data, from such scanner," as required by H.R. 4836. We plan to offer higher quality data, which is fully compatible with user equipment and programs, although of a different type. As I mentioned previously, the Space America system is market-oriented; band and resolution improvements will be an inherent part of the development process for our second and third satellites.

We urge amendment of your bill to adopt the House bill's base-line data requirement and evaluation criteria.

We welcome any questions you or your staff may have.

DETAILED COMMENTS ON S. 2292

Section 301(2). The language in this subsection indicates that Congress intends to use the six-year Transition period to determine if the private sector should operate land remote sensing. This will discourage private investment in the commerical follow-on and should be modified accordingly.

Section 302(4). This subsection references the need for proposals to describe a need for Federal funding; however, the bill authorizes no monies to carry out this subsection. This discrepancy should be rectified.

Section 303(a). The criteria for selection should be listed consistent with the selection criteria contained in the RFP, and should be weighted.

Section 303(a) does not include the "Commercial Viability" of the proposals as an evaluation criteria. Such a subsection should be added. A commercial U.S. Land Remote Sensing Program, not another Government contract, should be the goal of S. 2292.

Section 303(a)(1). See our testimony for comments.

Section 306. This seciton will discourage the private sector from investing in the commercial follow-on to Landsat 5. If the "feasibility of the transition," rather than simply "the Transition," is to be reviewed and reported on, it sends a signal that the Congress is not serious about allowing commercial land remote sensing operations. Also, the idea of sending up "legislative recommendations to accomplish such transition" in two years indicates erroneously that the Senate is not serious about S. 2292. The provision should be amended to resolve these problems.

Section 602(c). Requires the Secretary of Commerce to pay the system operator reasonable costs for reproduction and transmittal of data to the archieve. The Congress should consider who should pay the full cost to obtain data not yet obtained by the system operator to meet a customer order, but nevertheless requested by the Secretary of Commerce for the National Archive.

Amendment to S. 2292. Add the following section at the end of Title VI:

CHARACTERIZATION OF PAYMENTS AND ASSETS

607. All amounts paid to the contractor pursuant to a contract under Title III of this Act shall be treated as non-taxable income. All assets purchased by the contractor to carry out its obligations under such contract shall be treated as property located in the United States and eligible for investment tax credits and inclusion under the Accelerated Cost Recovery System.

STATEMENT OF PURPOSE AND NEED

This section characterizes the payments under the contract and clarifies the application of the tax laws to the assets being produced by the Title III contractor for this novel commercial enterprise.

The first sentence of this section avoids the anomaly that 46 percent of the payments made under a contract entered into under Title III will be returned to the U.S. Government as taxes if the funds are made available up front to fund the capital equipment needed by the commercial system operator. Because the operator will be required to capitalize the assets construced under the contract and because they cannot be depreciated until they are put into service, the initial payments will not be offset by deductible expenses in the years received.

The second sentence clarifies that the assets that the contractor procures to carry out the contract are eligible for investment tax credits and for depreciation under the Accelerated Cost Recovery System, just as communication satellites are, and notwithstanding the origin of the funds being used to purchase these assets.

Senator GORTON. Thank you.

Dr. Heiss.

Dr. HEISS. I am chairman of the SPARX Corp. I am very thankful for your invitation.

SPARX is a joint venture between the United States and a German company, MBB. Sixty percent is U.S. owned; 40 percent by MBB. We are currently very happy to be manifested and scheduled to fly on the space shuttle in August of 1984, but we would like to be the first commercial demonstration mission in remote sensing.

We expect, if allowed to fly, to get one-third world coverage from this one mission. We also are contemplating flying another five missions, using the shuttle system over the next 2 to 3 years, purely from the commercial sector, in a joint endeavor with NASA. Over those 2 to 3 years, we also would live with whatever data policy the U.S. Government would require of us.

The basic issue, however, that brings me here before you today, I believe to be a most important, critical issue in the history of the U.S. aerospace commercialization—critical to the U.S. aerospace industry. We should not set a bad precedent here. We do not think you want to in the contemplated legislation.

However, there are some items in the proposed legislation that give us concern and which could be either misinterpreted or misapplied if the legislation passed. We are not opposing the Landsat registration and the basic purpose of your bill. If it proceeds, fine; if it does not proceed, for whatever reason, also fine.

However, the specific language that we are proposing as an introduction and overriding amendment to your bill is worded as follows: "Nothing in this bill shall be construed to infringe in any form on the right of public or private persons to gather information at their expense from space for peaceful purposes, nor to infringe in any form on any property rights from information thus gathered." That is, the private sector paid for it; let the private sector have it for peaceful purposes.

"Nor shall any license or other regulation be required for such activities." Not on Landsat, which is publicly paid for information. For privately funded information, why do you need a license? Does it pose a health hazard or any other hazard? We don't think so.

"Nor shall any direction be given by any government entity as to the uses of such information." Peaceful information. "Nor shall any public or private person be denied access to space transportation and other services provided by the U.S. Government or any other U.S. person for the pursuit of such activities," Gathering of information at private expense is what we are talking about.

"Nor shall such activities be denied or discouraged when competing with whatever contractors may be chosen by the Secretary of Commerce under the authorization of this bill."

Briefly, as to historical considerations, let me just speak to those.

Senator Gorton, you come from a very splendid State, and your State, in worldwide competition, is providing the largest net balance of payment contribution to the United States from aircraft sales. There is a 60-year history through NACA and NASA on how to commercialize airplane technology. No licenses are needed nor requested. The R&D is being done by the Government, including demonstrations. I think companies in the State of Washington and those of Mississippi, Missouri, California, and so on, know how to commercialize.

Do not set a precedent here in the guise of commercialization to maybe achieve other purposes, if it is commercialization you are trying to achieve.

Airplane monopoly—let me give two or three analogies.

There was a big fight in the 1920's for the mail service to get the monopoly on all civil air transportation. Luckily, we resisted that temptation and were successful in a private approach.

In space communications in the early 1960's, there was, right in this Chamber, one of the most historic fights having to do with the first issue of space commercialization. Vice President Lyndon Baines Johnson came out and won one of the most important battles that today has laid the foundation for the largest commercialization industry, amounting to billions of dollars. But the issue then was, should not space communications be reserved for strict national security purposes?

Senator GORTON. Could we get you to summarize your testimony at this point, please?

Dr. HEISS. Those are the most cogent statements. One should not follow an area and create, in the guise of space commercialization, a monopoly in activities. Let the private sector, privately funded, have access and return. We can do so today by aircraft. Let us also do so using the shuttle, as long as it is peaceful.

Thank you.

[The statement follows:]

STATEMENT OF DR. KLAUS P. HEISS, SPARX CORP.

Mr. Chairman, this is in response to your invitation to comment on the draft of S. 2292 "To provide for continued access by the Federal Government to land remote sensing data from satellites, and for other purposes.".

SPARX is a U.S., State of Delaware corporation with 60 percent U.S. ownership and significant (40 percent) European ownership, dedicated—among other objectives—to flying the first commercial remote sensing demonstration mission on Space Shuttle Flight 41G scheduled for August, 1984. My own involvement in matters of Landsat dates back to 1968 (Rangeland management), 1973 (Landsat-C approval) and 1974 (Thematic Mapper program).

We greatly admire and support the basic initiative of your Committee in trying to establish and promote the use of remote sensing satellite data. I appeared before Congress and other committees repeatedly in the 1970's with testimony very similar in purpose to the objectives you are trying to accomplish with this legislation.

However, as desirous as we jointly are in bringing about these uses, some basic points have to be considered and accomodated—before this legislation can meet broad standards of congressional and judicial review and approval. Some of these principles override any valuable short-term objectives that this legislation tries to accomplish for remote sensing from space.

After thorough study of S. 2292 and being fully familiar with the principles that have guided United States Space policy ever since the Space Act of 1958 and President Eisenhower's "open skies" principles—insisting on and defending the unconditional "right to sense from space" and the "right to distribute" such data—and cognizant of the overriding constitutional principle of the freedom to gather publicly and privately whatever information one desires as part of the exercise of free speech, we respectfully recommend the following overriding addition to the purposes of S. 2292, with, if necessary, required changes in the rest of the language of that S. 2292:

"Nothing in this Bill shall be construed to infringe in any form on the right of public and private persons to gather information at their expense from space for peaceful purposes; nor to infringe in any form on any property rights from information thus gathered; nor shall and license or other regulation be required for such activities; nor any direction be given by any Government entity as to the uses of such information; nor shall any public or private persons be denied access to space transportation and other services provided by the U.S. Government or any U.S. person for the pursuit of such activities; nor shall such activities be denied or discouraged when competing with whatever contractor(s) may be chosen by the Secretary of Commerce under authorization of this Bill."

We believe that this addition to S. 2292 is of critical, fundamental importance to the preservation of "open skies" principles in Space hitherto defended so assiduously by the United States for the benefit of all mankind.

In the following, we list some of the underlying considerations which underly our belief about why the suggested addition to the language of S. 2292 is of such overriding importance:

Every since the inception of a civil remote sensing program by the United States in the mid-1960's, the ultimate goal of Federal remote sensing initiatives clearly was to see the commercial market take on these activities, in the United States and worldwide.

(1) *Historical Considerations about Aerospace Commercialization.* In this, the National Aeronautics and Space Administration followed the successful history of NACA (established in 1916) in the field of aeronautics and NASA's own science, research and technology initiatives under the Space Act of 1958.

By way of introduction and as as an important guide to the current decision at hand, it is useful to remember the past vagaries of fundamental Government sector v. private (commercial) sector decisions and activities in the United States in aerospace matters:

1.1 Airplane Monopoly Considerations by the U.S. Postal Service in the 1920's. One shudders to think what the history of U.S. commercial (civil) aviation would have been under the creation of a Government monopoly for all commercial aviation—a proposition seriously discussed and fortunately dismissed in the 1920's. Instead, the United States followed a commercial, private approach, which led to the creation of the most consistently successful sector of U.S. industry in terms of the *net* balance of trade contribution. NACA and NASA also have shown—in all of aerospace—the successful model of technology, innovation and commercialization, wherein the Government takes an active, early Research, Development, Testing and Evaluation (RDT&E) role, but leaves the commercial use and expansion of such technology to private companies and the marketplace.

1.2 Space Communications—Government (Military) Monopoly v. Commercial Approach. The other, and only, successful commercial space application sector to date—space communications—was faced with a similar, monumental decision in the early 1960's: the case was made that, indeed, space communications should be reserved for exclusive national security applications and, "second best" certainly preserved as a Government monopoly. The case for protecting national security considerations from "instananeous" worldwide communications may have been strong, but the United States resisted such monopoly considerations at that time.

The United States then took the further step, in the early 1970's, of "deregulating" all U.S. domestic space communications. This step was openly resisted by some Government agencies and parts of industry.

The history of success since then belies the timidity and lack of faith in the integrity of free market forces. Today, "deregulation" of communications on a worldwide basis opens vast prospects for worldwide market for U.S. technology and services—with access by U.S. companies to providing services in competition to presently existing monopolies in international space communications. The battle for "open skies" is being fought by the Department of Commerce through its very own NTIA.

Now the U.S. Government is faced with a related issue once again: of whether to take the plunge in commercializing remote sensing or to maintain and preserve a heavily subsidized, expensive Government service for civil remote sensing.

(2) Non-Discrimination Against Remote Sensing From Space. Any proposed legislation on licensing and regulating *civil* remote sensing from space seems to set a very disturbing and possibly unconstitutional precendent for licensing of *all remote sensing activities,* e.g. if remote sensing were licensed for space-based equipment, why not also for sensing from sounding rockets, aircraft (e.g. the Space Shuttle), or for television cameras on the ground and the open seas. Any licensing procedures for civil remote sensing seem to be in open violation of United States constitutional principles and U.S. "open skies" space policy since 1958.

(3) Freedom of Information Principle Applied to Government Funded Information. Any information gathering activity sponsored and supported by the U.S. taxpayers ought to be available under current, well-understood principles of the public's right of access to such Government funded information (for Landsat anywhere from $2 to $4 billion—1983 dollars—for the past 18 years). One should not create a Govern-

ment right to withhold civil information from some and not from others in any field. Nor should one introduce copyrights for such information, where such copyrights have been denied—rightly—by law for any Government held civil information. Nor should one resort to artificial institutional restrictions to avoid these issues. Hereunder Landsat information has been, is, and should continue to be available to the public under current rules, possibly with somewhat higher user charges to recover more of the taxpayers' funding.

(4) *Maintain Full Property Rights to Privately Gathered Information.* SPARX intends to fly two remote sensing missions a year during the development period (1984-1987) and four missions a year during full operations (1988-1997). This commitment by SPARX is possible as long as there is no infringement on the full property rights of SPARX to the data, information, knowhow, technology, products and services founded on and derived from the SPARX-01 and subsequent missions. Of course, SPARX is and always intends to be in full compliance with any existing or future U.S. statutes and laws or international treaties to which the United States is a party.

In addition, SPARX agrees to stay within the generally talked about "ten meter pixel resolution" standard for civilian remote sensing missions from Space, although no such resolution standard exists today for remote sensing under U.S. law from the air, ground or open sea, including aircraft and sounding rockets.

Any further regulations, restrictions or understandings imposed on an enterprise carrying out remote sensing from Shuttle-based instruments when full payment of the Non-U.S. Government Space Shuttle user launch fee is made, which infringe in any form on the property rights of the enterprise—in particular to data gathered by a mission paid for by the enterprise—should be unacceptable to potential users of the Space Shuttle System, whether for remote sensing (domestic and worldwide), materials processing, communications or entirely new applications.

SPARX is aware of the concerns on the part of some concerning the full extension of the "open skies" policy, first announced by President Eisenhower in 1958, relative to commercial enterprise in Space which we now seek. We submit that these concerns are inappropriate and are typical of those who lack confidence in the dynamics of the world marketplace and in the great potential which commercial Space enterprise holds for the United States and other free market economic. We believe the United States should be first and formost in the full defense of the "open skies" and free market priciples in Space rather then submit to the fallacy—proven again and again in the history of economic enterprise—of protectionist and "regulatory thinking" in the form of rules imposed by central authorities who wish to maintain bureaucratic controls over free enterprise.

(5) *Freedom to Gather Information and Freedom of Speech.* The proposed licensing regulation procedures for civil remote sensing—say, by television cameras—set, in my opinion, an unconstitutional precedent on the right by anybody—however one sees fit—to gather, store and distribute information. Information privately paid for is, and should continue to be, the full property of whoever paid for such information. Any licensing, regulation or restrictions by the United States on such civil information gathering would seem to be counter to every underlying U.S. policy in fields such as communications, press and speech (e.g. UNESCO issues, objectives of the National Telecommunications and Information Agency and of the Department of Commerce, etc.).

(6) *"Open Skies" v. "Closed Skies".* The "open skies" policy has rightly been guiding U.S. space policy ever since it was first pronounced by President Eisenhower and complements other important ground and open sea principles.

SPARX believes that the very maintenance of the "*open skies*" principle—and the unconstrained *right* to sense from Space and to distribute such data however one desires—espoused by the United States so consistently since 1958, requires that the United States not change these principles for commercial remote sensing by adopting a "*closed skies*" policy which would require prior U.S. approval, regulation or licensing for launches on the Space Shuttle.

(7) *Landsat Monopoly vs. "Open Market" Competition.* In no way do we imply any prejudgement of any proposed Landsat data distribution policy, which we understand to contemplate continued government subsidization and required distribution at less than cost to all comers, possibly with no recovery of prior development or investment costs. We are not asking the U.S. Government to desist from any such or similar course on programs funded for so long by U.S. taxpayers (even though this could have a negative effect on any private remote sensing enterprise). We are only asking the U.S. Government not to infringe on rights of any commercial remote sensing mission that pays the Standard Non-U.S. Government User Charge.

Indeed, SPARX is looking forward to fully utilizing any past and continued U.S. Government subsidized Landsat data or any other available data.

However, SPARX believes the United States should not be artificially deprived of commercial remote sensing—from Space, the air or the ground-while the Government continues to provide essentially free information through Landsat.

To maintain Government civil remote sensing through continued Government subsidization is one thing; to prevent private competition in such activities by denying open access to commercial remote sensing missions by SPARX or anybody else is, we believe, unwarranted.

(8) *The Ills of Government Protectionism.* The issue, we believe, is not whether civil remote sensing can be "controlled" by the United States through regulating access to Space, but simply whether the worldwide community will make use of U.S. launch systems, technology and data processing or use those of competing, foreign nations and entities. Ill-advised protectionism by the United States at this time by attempting to control the distribution policy of civil remote sensing activities, would only do great economic harm to the United States in the late 1980's and 1990's. In this we believe NASA should learn from the negative lessons of attempted technology protectionism in Space matters during the 1970's, namely:

8.1 The denial by the United States Government of a European development of the Space Tug in the early 1970's as the European contribution to the full development of the U.S. Space Transportation System. Without such denial it is very likely that (a) no competing European launch system would exist today, (b) the United States would have at its disposal a reusable upper stage that could retrieve and deliver payloads to their designated orbits, constituting a full space transportation system out of the current Space Shuttle System; (c) the United States might have foregone the PAM-A, PAM-D, U.S. Shuttle Centaur and other interim *non*-solutions; and

8.2 The denial by the U.S. Government of the full commercialization of the Delta Launch Vehicle by the European Space Agency in French Guiana—which (in our opinion) led to the final ESA decision for the full European launch capability—and a $6 billion plus order book for Arianespace.

In other words, the U.S. Government has created its own competition to the Space Shuttle System through "protectionist" decisions in the 1970's.

Looking forward to the 1990's, the United States, in our opinion, has two broad options:

(1) A full "open skies—free market" commitment by the United States in Space matters, which would lead to a substantially enlarged *use* by the worldwide community of a full range of Space services from the United States (rather than from other sources), be it in Space transportation, Space communications, Space remote sensing and materials processing; or

(2) A *"closed skies—protected market"* policy guided by technology and regulatory barriers in the *supposed* pursuit of U.S. interests, which will only add up to a gradual—and ultimately total—disenchantment of the international community with the *use* of U.S. Space technology services. Such a policy will also *artificially stimulate* the development of competing systems and technology which would not come about in an "open skies—opan market" environment.

It is also our belief that a "closed skies" or "regulated skies" policy for civil remote sensing raises grave constitutional issues in that some government person(s) could unilaterally determine access to worldwide civil information gathering—something we understand is totally unacceptable to the United States policy with regard to the worldwide gather, flow and publication of information.

Given the above considerations and the importance of the new opportunities we see in remote sensing in Space, we hope that a quick and early conclusion can be reached on a suitable polcy on how to transition in the next three to four years to a truly commercial, "open skies", free civil remote sensing market. We are glad to extend any help we can offer in this regard. At the same time we also count on the full support of Government, including Congress, in seeing that such an open, commercial approach is adopted so that the United States can compete fully for such services in the late 1980's and 1990's.

Violating "open skies—free market" access now in civil remote sensing opens the door to further initiatives by other nations. It is a path the United States should avoid.

OTHER, SPECIFIC COMMENTS

P. 1, 1. 4: Omit "Communications"; land remote sensing missions can be flown with the Space Shuttle without transmitting such information by means of telecommunications.

P. 3, para. 9, 11. 1–4: In our opinion, not correct; the private sector can, and SPARX (among others) proposes to develop civil land remote sensing systems—particularly since the Space Shuttle makes lower cost and lower risk land sensing operations possible.

P. 3, para. 10, 11. 5–10: The Federal Government has failed to provide Landsat data continuity. A private sector approach to meeting *stated* Federal demand for Landsat type data promises higher assurance of data coverage and data continuity than Federal co-management subject to the vagaries of the Congressional budget process, e.g., near-cancellation of Landsat C (1973), postponement, delay and cost escalation of Thematic Mapper Program, lack of backup systems, nondiscriminatory (i.e., timely) access to Landsat data by worldwide user community.

P. 3, 1. 20: Substitute "expeditious" for "gradual".

P. 4, para. 3: Proposed substitution: "reaffirm the right of all nations to sense the Earth's surface and acquire land remote sensing data, and the right to distribute such data to all users."; *alternatively:* substitute "and the principle that Landsat data" for "so long as such data".

Comment: Clearly, the legislation should state the *right,* but not the requirement, to make all land remote sensing data available to all potential users. The United States, for one, has not been and is not distributing all land remote sensing data (e.g., high resolution data); similarly, the United States should not impose its interpretation of "nondiscriminatory" on other nations and users. This paragraph (as written in the proposed legislation) is an invitation to any non-U.S. user to commit to civil remote sensing ventures with non-U.S., competing systems and may prevent the full use of U.S. space technology (Space Shuttle, spacecraft, civil remote sensing instruments).

P. 7, 11. 12–13, 16, 20, 21, 24–25: Insert "Landsat" to read "unenhanced Landsat data"; alternatively: "Contractor" data.

P. 13, 1. 2: In "landsat" sales levels; alternatively, "Contractor".

1. 17: Enhanced "Landsat"-type remote sensing data; alternatively: "Contractor".

1. 14: Contractor "beyond the initial commercial operations period of, say, five years." The effect of this paragraph (as currently written) is to negate any early commercialization of civil remote sensing. The Federal Government is one of the principle users of civil remote sensing data. To negate to any any commercial supplier the ability to enter into a medium term, guaranteed contract to supply data negates *any* ability by the supplier to commercially provide such data and services at *substantially* reduced cost to the Federal Govenment. The paragraph *guarantees* continued Federal involvement, management and overhead cost of a system where the texpayer to date already has spent between $2 to $4 billion (1984) dollars.

P. 13: Insert new paragraph between lines 2 and 3: "No Federal Subsidization shall be given to a contractor under this legislation where competing private land remote sensing entities are offering similar data."

P. 10: Insert between lines 6 and 7: "(4) assure that no monopoly civil remote sensing enterprise be created, directly or indirectly, through this legislation or any acts by NOAA, as the forces of open market competition should be encouraged rather than foreclosed, particularly as to distortions introduced by subsidization of one enterprise over potentially different ideas and systems designed to provide similar services by others."

Pp. 14–17: Licensing: omit "totally"; no need for such procedures, which violate "open skies" principles and set a dangerous precedent.

P. 18, Sec. 601 (a): The principle of "open skies" pronounced herein is clearly contradicted by the "licensing" requirements of Title IV. Also, by qualifying "open skies" principles with "nondiscriminatory" requirements the United States possibly opens itself to adverse international legal issues where, to date, the United States position on "open skies" has been clearly on the right to sense and the *right* to distribute data, without *any* qualifications whatever. Other nations might follow U.S. "licensing" requirements with their own "licensing" requirements "to be sensed".

P. 20, 1. 6, Para. (d): This paragraph seems (a) to be in some contradiction with freedom of information provisions (Federally funded) to civil information held by the Federal Government; (b) to contradict the "open skies" principles espoused in other sections of this legislation; (c) to create an unwarranted monopoly, and hence, inefficiency; and (d) to assure continued high Federal funding requirements.

P. 21, Sec. 603: Seems to contradict freedom of information principles, as well as "nondiscriminatory access" to data provisions pronounced earlier in the act.

Senator Gorton. Dr. Heiss, I understand that the Outer Space Treaty of 1967 and the 1974 Convention on Registration of Objects Launched Into Outer Space require nations to authorize and be responsible for outer space activities of their nongovernmental entities.

In addition, the 1972 Convention on International Liability for Damage Caused by Space Objects makes nations liable for damage caused by those objects.

Do not these international agreements make licensing requirements for private remote-sensing ventures necessary?

Dr. Heiss. No, they do not, in our opinion.

However, I do think that whatever is required to meet those purposes can nicely and adequately be met, and are today being met, by the Standard Shuttle Launch Services Agreement of NASA. All these concerns—registration, liability issues, health issues, are met. There is nothing special needed on top of that to meet the concerns of the Outer Space Treaty. After all, our system that we propose to fly in August has already flown, and it has not posed any hazards to health or security or third parties.

You have to take insurance out to cover the specific provisions of those treaties.

Now, I also would like for the record to state that nothing in those treaties ever contemplated a process to impose, for example, reasonable prices on private activities or to make all information available by private entities specifically to the market, at expense and cost to such an entity; nor do I think that that contemplates the prohibition of licensing of sending a television camera, say, into space by one of the public networks, come back, and then do with those items what they would like to do.

I think that interpretation of those specific treaties has been carried too far in application to remote sensing. That does not mean issues have been discussed or not discussed. I understand U.S. policy over the past three decades to have involved two key principles—and very important to the United States—on this issue. One, the right to go into space and sense anything, worldwide, without any approval by anybody. We propose to live by that standard.

Second, and also important, the right—not the duty—but the right by the United States to distribute any data it chooses to anybody it likes. Those are the key overriding provisions.

There has been and is a concern by poor nations to have access to data in remote sensing at low cost. Let the Government assure those nations of such access through Government programs. Do not ask industry to provide subsidization or subsidized data.

Senator Gorton. Thank you.

I have heard widely differing views on the issue of prohibiting reproduction of data. For all of you, starting with Mr. Schmidt, would you summarize your feelings on whether legislation should make remote sensing data eligible for copyright?

Mr. Schmidt. Well, it's really our major interest that there is some language in the bill that sounds to us like we are back competing with the Government on the rights and sale of data. We think that for whatever period a commercialized operator is recognized from the U.S. Government, that the rights of sale of all that data should be his, and at the very least, if there is data available from some other Government-sponsored sensing program, then the commercialized operator should, as a minimum, have the right of first refusal in terms of attempting to market that data.

Mr. Sinkewiz. I think our position is basically the same as that. If a company was commercially responsible for an operation such as this, then data should be copyrighted.

Ms. Josephson. We agree. We feel strongly that the data should be copyrighted. At the moment, there is a strong—I guess I would call it white market—for the data, since it is not illegal to distribute it. But for $100 you can get a copy of a Landsat scene from entities other than the Government, which obviously undercuts the Government's market. Indeed there is a list of all scenes available in the private sector indicating where you can go and get a copy very cheaply.

Now, if you are the space system operator trying to recoup your large capital investment and to create a business, you really cannot be successful if this kind of white market distribution of scenes continues.

Therefore, we strongly believe that the data should be copyrightable.

Dr. Heiss. Copyrights exist today for remote-sensing information. I think the issue here is should information be copyrighted that was gathered by public expense? And I do think that that is a necessary item in the legislation to make the commercialization of Landsat possible, and I support that.

The issue is, however, not copyrights. Those exist. The key issue is can you copyright information that was gathered at the taxpayers' expense? And, to date, the history in the United States has been not to do so.

I do think it is warranted, and one should support such new rights for this purpose, in order to achieve the basic purpose of the legislation.

Senator Gorton. If commercialization were to proceed according to the framework of S. 2292, what do you think would be the appropriate duration of a contract for development of a followon system to Landsat?

Mr. Schmidt. We have proposed a 12-year period in our proposal to the Government, and have defined that in three phases. That was the period that we found necessary for the investments that had to be made by our joint venture in order to satisfy a reasonable return on those investments.

Senator Gorton. Mr. Sinkewiz, can you—taking that "if," which you are opposed to—respond?

Mr. Sinkewiz. I will have to preface it with the—actually, what I was going to respond that our position of course, is that it is premature for commercialization, and that I believe that a part of the process would be the market development. And based on that factor and what the needs are of the marketplace, that that period of time would be a fallout of the financial analysis that would result from the market that potentially would be developed.

I think at this time it is premature, as is commercialization, to make a judgment on what that period of time would be.

Senator GORTON. Ms. Josephson?

Ms. JOSEPHSON. Our proposal corresponds with the House bill which requires a contractor to propose a 6-year data capability.

Dr. HEISS. I am indifferent, really, to the time period, but I suspect the more expensive the proposal, the longer the time period that is desired. And, hence, I would be very suspicious of any length of time period. The market and competition should prevail.

Senator GORTON. What research and development role do you feel is appropriate for the Federal Government in remote sensing if Landsat is commercialized?

Mr. SCHMIDT. Well, even though in our proposal, we have put together a plan that would continue to develop the sensing technology to the level that we can best describe and put boundaries around. We still believe that there are other elements well outside of our joint ventures capability to fund, and we think that NASA ought to continue to be looking for further developments to maintain the U.S. position and leadership in all areas of space.

Mr. SINKEWIZ. If we do not continue the development of new technology, including the continuation of the thematic mapper quality data, I believe that we will find that we will be relying upon foreign sources for all of our land resource data. So I think it is an absolute necessity to do that.

Ms. JOSEPHSON. We strongly support a continuing Government R&D role through the various agencies. We see the Government role being more in the basic R&D area. As a commercial operator, our own R&D would be more focused on tanslating this basic R&D into operational systems.

We will have our own R&D program, and we have a very strong commitment to such a program.

Dr. HEISS. NASA and NACA have a 60-year successful history on how R&D should be funded by the Federal Government.

Two, access to such R&D should not be reserved only for whoever wins under this contract that is contemplated. It should be open access by all in competition.

Three, beware of setting bad examples. In communications where R&D was precluded by NASA, the private sector did not take over, and there were very important communication technology initiatives in space lost by the United States that today we try to recapture.

Senator GORTON. Mr. Sinkewiz, do you feel that market development can occur while the system is operated by the Federal Government?

Mr. SINKEWIZ. Yes. I believe that is a viable alternative; that is, to continue the Government-sponsored program as basically it is existing now, and at the same time, have the private sector pursue a market development program so that in several years, in some number of years, like 3 years or so, we could have a better understanding of that market and, in fact, have that market develop so that we could approach the commercialization issue, I think, with more data, more understanding, and hopefully with less subsidy by the Government.

Senator GORTON. For all of you——

Ms. JOSEPHSON. Mr. Gorton, could I respond to that?

Senator GORTON. Sure.

Ms. JOSEPHSON. I just wanted to add a footnote. I was at NOAA when NOAA got the responsibility for the commercialization of Landsat. We developed a marketing program, since our job was to commercialize Landsat, or at least to start it on its way toward commercialization.

We went to OMB with our budget request, and were told that the role of Government is not to expand the demand for Government services. So my own personal experience of trying to get a marketing program for Landsat data going in the Federal Government was an absolute bust.

Senator GORTON. If a law is enacted to allow the RFP process to result in the award of the contract, several factors, obviously, will be considered in evaluating those proposals.

Some of them are potential for market development, quality of data, data continuity, cost to the Federal Government.

I would like each of you to comment briefly on what factors you think should be weighed in what fashion, and why.

Mr. SCHMIDT. Well, definitely, as we say, no matter what else we do, if legislation is not completed in time and in concert with the evaluation of the proposals, there is going to be absolutely no doubt a discontinuity, and the only question is how many months or how many years.

That discontinuity could make all of this moot, because you will not develop a commercial market with a large gap.

After that timeliness, which is the enabling of the commercialization, we think that really you have to have a system that has taken care of what we think is going to be the real grabber for the user industry and give him the data that he wants and be able to compete with what the foreign govermments will propose, or what we think they are proposing.

And the last, of course, but absolutely not least important—probably the biggest task to do—is to put together a marketing organization that knows the potential marketplace and goes out and sells and sells and sells, because that is the only way you are ever going to pay off the considerable investments that are required here.

And we have taken a look at all the areas that have been mentioned by the panel. We think, in our proposal, we have treated each one of them. We recognize the difficulty of even defining this market. We also recognize the difficulty of establishing it. We know how much money we think we need to do the job, and we have done it in a way that we think we answer all these questions in our proposal, and that there are just differences of opinion from different organizations.

Mr. SINKEWIZ. I believe the criteria that should be considered very strongly by the committee is the market development aspect. That is to say, I believe that in order for a commercial venture to survive and be profitable to the company, that market development is a necessity, and I think that that market development not only is dependent upon the ability of a company to perform that function, it is also dependent upon data continuity.

So I believe data continuity is another factor that should weigh very heavily in the evaluation. That is, again, if there is a long data gap in the system, the foreign sources will take over the market that potentially has been developed or is being developed.

Third, I would say that it would be necessary to have TM quality data, because I believe that even though right now we do not have a large market there, I believe that that is where a market can be developed and will benefit commercialization.

Ms. JOSEPHSON. I think the most important thing to establish in commercializing this system is to look at the appropriate balance between the definition of the market and the technical system which is proposed to meet that market analysis.

I think it is important to establish that this whole system is market-driven, not technology-driven. Data continuity, as the gentleman to my right mentioned, is also important. From the point of view of users, it is very difficult to expand the market if they do not believe the data is going to be there on a continuing basis. They are not willing to make the capital investment and other investments required to use the data operationally.

Those would be my primary comments.

Dr. HEISS. First and foremost, given the purpose of the legislation, does any proposal substantially reduce the cost of the current ways of doing things? If technically, or through promises and uncertainties, that is not clearly the case, then the key criterion should be but is probably not met.

Second, any system that is approved should have the flexibility, even over the next 4 or 5 years, to carry other U.S. remote sensors. Many companies in this country are very capable in remote sensing instruments that could be applied in civil areas. They should not be excluded from having their instruments carried on whatever contractor that is chosen, parallel to, simultaneous with, or whatever.

And only the space shuttle, in our opinion, offers that flexibility.

Three, in no case should any monopoly be created to exclude at least private competition against the winning contractor.

Those would be my three selection criteria.

Senator GORTON. I have always considered the term "open skies" to be synonomous with the nondiscriminatory availability of data.

Would each of you comment briefly on what open skies means to you, and how it should be addressed in any legislation?

Mr. SCHMIDT. In a previous question that was asked like that, I believe that open skies means that everyone is entitled, inside of certain bounds of national security, to ask for particular data scenes. I believe that there are data scenes whose value is very perishable if you are providing a scene that someone has to use right away for some specific information, I do not think that should be available to anyone else from the archives until a fair amount of time has passed for him to gather his use out of it, unless it has been ordered with precisely the same instructions by someone else.

In other words, I do not think you should get an order for a scene, and then put it up on an auction block. I think you have to respect the rights of your customer and inside of that and national security, I do not see any other problems with the open skies.

In prior testimony I asked for some aging of data before it went to the general public for archival retrieval.

Mr. SINKEWIZ. I have no additional comment.

Ms. JOSEPHSON. We understand open skies to mean nondiscriminatory access on an equal basis to all users. We plan to continue the current U.S. data distribution policies. We will maintain anonymity of users' names, so that other users will not know who has bought the data. But we do not plan to hold it for any period of time. Anybody who places an order will get it on the same basis as everybody else.

Dr. HEISS. I think the aircraft analogy is perfect. I come back to President Eisenhower in 1954. Nondiscriminatory clearly should mean and ought to mean that anybody who wants to collect data and pay for it has a right to hire an aircraft, do the remote sensing, and come back. If he paid for it, those tapes are his to use.

Secondly, everybody else should be able to come to the same aircraft firm and say I also want to have a survey flown. Then if the contractor says no, I will not fly you or your remote sensing mission, he will be discriminating. That should not be allowed.

Open skies does not mean—does not mean—making data available at no cost, or close to no cost, to everybody. It is not and never was meant to be an agreement for subsidized worldwide data distribution. You cannot have space remote sensing commercialization and apply such an artificial interpretation to what open skies means.

I do not think it was ever in anybody's mind until very recently.

Senator GORTON. Thank you all for your contribution to the process here today.

Our second panel consists of Ray Williamson of the Office of Technology Assessment; William Spann of Metric, Inc.; and Charles Sheffield of Earth Satellite Corp.

Mr. Williamson.

STATEMENTS OF DR. RAY A. WILLIAMSON, PROJECT DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT; G. WILLIAM SPANN, PRESIDENT, METRICS, INC.; AND DR. CHARLES SHEFFIELD, VICE PRESIDENT, EARTH SATELLITE CORP.

Dr. WILLIAMSON. Mr. Chairman, thank you for the opportunity to appear before you today.

Dr. Gibbons, who was to appear, asked me to extend his apologies.

I am Ray Williamson, the project director for International Cooperation and Competition in Civilian Space Activities, a study of the Congressional Office of Technology Assessment.

My testimony is based on a technical memorandum related to that assessment, entitled "Remote Sensing in the Private Sector: Issues for Discussion." I have here a copy of the technical memorandum.

We have grouped the issues relevant to this hearing into five categories, most of which are addressed by S. 2292.

I will summarize our major findings, briefly.

First, commercial viability. We have concluded that until the market for remote-sensing data expands substantially and a more efficient system is in place, it could cost the Government as much to subsidize a private owner as to continue operating the system itself.

The crucial element in establishing a self-sustaining business is the size of the market, as some other people have said today. In fiscal year 1983, for example, data sales totaled only $7 million, and although the total revenue increased in fiscal year 1983, in part because of increased data charges, the number of items purchased fell by over 60 percent.

So the future data market is very uncertain, based on this. At present, nearly the only market for Landsat data is for the moderate resolution multispectral scanner data products. The Federal Government is the largest customer.

In the first few years of private operation, it will be extremely important for the operator to maintain sensing and distribution of data at least equivalent to that provided by the MSS. Market growth will hinge on advances in computer hardware and software that will make data manipulation, storage, and retrieval simpler and less expensive.

It will also depend on the ability of those who process land remote sensing data, the so-called value added industry, to turn the data into information useful to customers such as farmers, commodity traders, forest companies, and minerals companies.

Second, public benefits. There are many public benefits of the current Landsat system. If the transfer is made, we should not lose the public benefits which it supports. The Government could continue to support its public benefits by one, creating a complete archive of cloud-free multispectral scanner images of the world; two, increasing support to university research programs; and three, encouraging State and local governments' uses of the data.

Third, international relations. The foreign policy issues are both the most significant and the most difficult to resolve satisfactorily. Promoting U.S. foreign policy objectives might put such constraints on a private firm as to make such an enterprise unprofitable or require a large and continuing Government subsidy to make it commercially viable.

It is particularly important for the Government to assess the foreign policy benefits from public ownership of the technolgy and for the Departments of Commerce and State to find imaginative strategies for continuing to use remote sensing data to the advantage of the United States in relations with both developing and industrialized countries.

For example, the data distribution policy of the Landsat program is a cornerstone of the U.S. open skies policy and of the principle of using space for peaceful purposes. In our opinion, altering that principle of the nondiscriminatory data sales by allowing the private sector to set its own data sales policy would be harmful to U.S. foreign policy interests.

In addition, from the standpoint of maintaining good relations with developing countries, it may be in the best interests of the United States to restrict the private operator from entering into the value added business, or at least to regulate it closely to prevent such a company from exerting unfair economic leverage over others.

Fourth, national security. It is little appreciated that our intelligence and defense communities, taken together, are the largest current customers of land remote sensing data. If there were no appropriate civilian Government system or sufficient safeguards on a privately owned system, these communities might decide to build and operate their own system, thereby diminishing any expected budget savings, and possibly increasing the net cost to the Government.

Fifth, international competition. As we deliberate, other countries are developing their own land remote sensing systems. Canada, France, India, Japan, and the European Space Agency all plan to launch remote sensing satellites by the end of the decade. They see the development of these systems as an integral part of their emergence as space powers. Their governments are deeply involved, and are subsidizing commercial ventures.

If Congress wishes to maintain U.S. leadership and competitiveness in remote sensing, it will be essential for the United States to maintain program continuity and timely and affordable data. This would almost certainly require sizable Government subsidy through the 1980's. It will also be important for the Government and the private sector to sustain a vigorous program of research in both space systems and data application systems.

That concludes my statement.

[The statement follows:]

STATEMENT OF DR. JOHN H. GIBBONS, DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT

INTERNATIONAL AND DOMESTIC IMPLICATIONS OF TRANSFERRING LAND REMOTE SENSING TO THE PRIVATE SECTOR

I am pleased to testify today on a range of issues raised by the proposed transfer of land remote sensing system to the private sector. My testimony is based primarily on a technical memorandum that OTA recently published, entitled *Remote Sensing and the Private Sector: Issues for Discussion.*[1] The technical memorandum identifies requirements and conditions that Congress might want to impose if the Landsat system is transferred to the private sector. It also summarizes the social, economic, and political benefits of the U.S. remote sensing program.

OTA is now engaged in a broad, independent assessment of the state of international cooperation and competition in civilian space activities which was requested by the House Committee on Science and Technology and the Joint Economic Committee. Because the results of this assessment are not yet available, my remarks on the relationship of U.S. domestic policy to the international realm are necessarily limited to a preliminary statement of our findings.

The issues related to transfer of land remote sensing to the private sector can be grouped into five categories: 1) commercial viability of a private land remote sensing corporation, 2) maintenance of the public benefits of land remote sensing, 3) international relations, 4) national security, and 5) international competition. Some of these issues can be addressed directly through legislation, such as Senate Bill 2292. Others are more properly dealt with in the continuing process of oversight.

1. Commercial Viability of a Land Remote Sensing Corporation

A major aspect of the proposed transfer that policy makers must consider is whether, and how soon, a private land remote sensing enterprise would become commercially independent. On the basis of qualitative analysis, OTA concludes that until the market for remote sensing data expands substantially, and more efficient spacecraft are developed and deployed, it could cost the Federal Government as much to subsidize a private owner as to continue operating the system itself. It could take as much as a decade for a sufficient data market to develop to sustain a self-supporting business.

In *Civilian Space Policy and Applications,* an earlier assessment requested by this subcommittee, OTA outlined several possible options for land remote sensing.[2] That

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[1] *Remote Sensing and the Private Sector: Issues for Discussion* (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-TM-ISC-20, March 1984.

[2] *Civilian Space Policy and Applications,* (Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA-STI-177, June 1982, pp. 53–67.

report noted that phased transfer to the private sector is more likely to result in a self-supporting business than rapid transfer. In a phased transfer, the Government would support part of the system (for example, the space segment) while encouraging the private sector to develop a market for primary data, information products, and a more efficent data collection and distribution system.

Remote sensing data market

The most crucial element in establishing a self-sustaining land remote sensing business is the size of the market for the data. Although the future market for remote sensing data is highly uncertain, current information on data sales allows us to make some general statements about its likely characteristics. As the attached figures demonstrate, the amount of data sold to customers has declined in recent years. A three-fold *increase* in the price of data in October 1982 resulted in nearly a three-fold *decrease* in the number of items purchased last fiscal year.

At present, virtually the only market for Landsat data is for multispectral scanner (MSS) products. Therefore, in the first few years of private operation it will be extremely important for the private firm to maintain sensing and distribution of data equivalent to that provided by the moderate resolution multispectral scanner (MSS). Current demand for the more expensive, higher resolution data from the thematic mapper (TM) is extremely small. Most customers have neither the experience with TM data nor the equipment to process them. In addition, it is not yet clear that TM data or their equivalent will be cost-effective for most routine tasks. Nor will it be possible to judge their long-term efficacy until they are available in quantity on a continuous basis and are delivered promptly. With the exception of the mineral exploration companies, which can make cost-effective use now of the more expensive TM data, few users are now willing or able to purchase them.

The major reasons offered for transferring remote sensing technology to private hands are that the private sector excels both at innovation and at developing markets; the U.S. Government does not. Although a potential exists for greatly expanding the market for land remote-sensing data and services, it is clear that a strong market will never develop until the Government or the private corporation can provide data continuously and promptly over an extended period of time. The major complaint OTA has heard from data users, all of whom are potential customers of a private firm, is that historically Landsat data have not been delivered as quickly as needed, and that there has always been the threat of termination of the entire program.

Future developments in the data market

Several factors may affect the growth of the data market. One significant recent development is that some customers (e.g., agricultural users) who require highly time critical data have learned how to use the more limited spectral bands and low resolution available on the meteorological satellites (metsats) as a supplement to Landsat data. Although the data from the polar-orbiting metsats are of much lower resolution, they have the advantage that they are delivered to the user immediately and are available from a given area daily, rather than every 16 days, as is the case for data from the Landsat system. As users gain more experience with metsat data and learn how to incorporate them in their models of agricultural production, these alternative data will to some extent displace the use of Landsat data. On the other hand, Landsat data would still be needed to calibrate the metsat data and to act as controls. If the land remote sensing data did not exist at all, estimates of future crop production would be much poorer. Many other tasks, such as geological exploration and mapping, will require continued availability of moderate to high resolution afforded by dedicated land remote sensing spacecraft.

The growth of the market for remote sensing data will depend directly on advances in information technology that will make data manipulation, storage and retrieval simpler and less expensive. Remote sensing data services are beginning to be integrated into the information industry. As the states and certain private corporations are discovering, Landsat data can be used to enhance the quality of their judgments concerning resource management and exploitation. Interpreting land remote sensing data and integrating them with related data require extensive use of computer hardware and software. Inexpensive and simpler means of processing and handling those data could significantly increase their use by making the data available even to relatively unsophisticated users.

OTA has found that copying and sharing data among users is common at all levels and for all types of users, a practice that has undoubtedly reduced sales. The private owner of a land remote sensing system is likely to copyright the data. If copyrighting the data helps to increase sales and therefore helps to reduce data prices, it could enhance market growth. However, some buyers, such as university research groups, and some local communities are likely to be priced out of the market if prices rise to full cost recovery or higher. The Government could aid the development of the data market and help certain users by providing funds for these users to purchase data.

Value-added industry

The data-processing companies already constitute a small, but growing specialized industry that will have an important role in any process of transfers from a Government-owned system to a commercially viable private system. Processing the data to extract usable information may cost two to four times the price of raw data. Also, one Landsat image can be processed in several different ways to yield different information. Thus, most of the revenue to be earned from land remote sensing is in the so-called value-added part of the business. Petro-mining, agriculture, hydrology, land-use planning, and oceanographic services all benefit from services provided by value-added companies. These companies supply services and products that can significantly alter the decisions their customers may make.

As I point out later in this statment, for the United States to maintain its technological leadership in remote sensing technology, it will be important for the Government to continue a strong program of research and development, both in sensors and in applying the experimental data to solving resource and environmental problems. In the past, as part of its research program, the Government has supplied computer software and data to users to help them become involved with the Landsat system.

The private value-added industry is now quite capable of supplying many services that were once supplied by NASA and the EROS Data Center, as well as extending the utility of remote sensing data to new areas of interest. In some cases private-sector methods for extracting information from Landsat and metsat data are more capable than civilian Government systems. The Government's research program should be structured in such a way as to enhance private-sector efforts rather than compete with them. In particular, the Government should not compete with the value-added industry in offering services.

2. The Government Role in Maintaining Public Benefits

Any changes the United States makes in the institutional structure and ownership of our land remote sensing system should be carefully considered to take into account the public benefits land remote sensing provides. Data products from the Landsat system have demonstrated to a widely distributed but dedicated user community both within and without Government that satellite data can be highly effective in meeting their needs for repetitive, synoptic coverage of Earth's surface in several distinct wavelengths and at uniform illumination. Several Government agencies, including the Department of Agriculture, the Department of Commerce, the Department of the Interior, the Central Intelligence Agency, and the Department of Defense, now use these data routinely for a variety of tasks related to mapping, assessing, and managing renewable and nonrenewable resources. Many of their data needs are related to meeting legislated requirements for managing Federal lands. By building a strong market for data and by supporting the development of value-added services, the private sector could enhance the availability of these and other public benefits.

Yet data users are particularly worried that the transfer will result in no U.S. system at all after Landsat 5. They feel that because the Administration is so anxious to move Landsat system out of Government hands, if the transfer were to fail, users would be faced with purchasing data from the French SPOT remote sensing system in the latter part of this decade.

Archives

The EROS Data Center (EDC) currently maintains an extensive archive of Landsat and other land remote sensing data. Although keeping all data would be prohibitively expensive, it should be possible to construct a complete set of cloud-free images of MSS data for the entire world. To date, this has not been done, although such an archive would have considerable value for mapping, land-use planning, and for mineral exploration, as well as for research on time-dependent changes to the environment, such as deforestation and desertification. OTA believes that the Federal Government should consider compiling and maintaining such a data archive, whether or not Landsat is transferred to the private sector.

University programs

In addition to their role of developing and instructing in the use of new technologies, universities and other not-for-profit organizations have carried out research in using Landsat data for themselves, State and local governments, private industry, and the Federal Government. Faculty members express two major concerns: 1) the steeply rising prices of Landsat data and the concomitant decrease of Federal research support have caused some universities to reduce severly their research and teaching programs; and 2) both the operational and research aspects of the U.S. Landsat program lack direction. As universities see it, these problems presage futher reductions in their teaching and research programs related to land remote sensing. Yet these institutions play a major role in transferring technology developed within the Federal Government to state and local government, foreign governments, and private industry. Whether or not the Landsat system is transferred to the private sector, the Federal Government should consider whether a subsidy for these university programs would be a worthwhile investment in future productivity and economic growth.

State and local government

Several states have begun to use Landsat data for long-term planning by adding them to large-scale computerized information retrieval systems. However, the expense of large computers and software and of training and maintaining personnel, combined with uncertainties about Federal policy, are inhibiting the states from relying more heavily on Landsat data. Transferring the system to private ownership might stabilize this situation and provide better service to the states and local governments. Still, states worry that if the transfer takes place, they will pay much higher prices for data, and, because private firms are likely to copyright the data, they will be prevented from copying data and sharing them among themselves, thereby further raising their costs.

3. International Relations

Transfer of the Landsat system to the private sector would assuredly affect our relationships with other countries; foreign policy issues are among the most significant and difficult to resolve in a satisfactory manner. Constraints on a private firm that are sufficient to protect U.S. foreign policy objectives could well make such an enterprise unprofitable or require a largfe and continuing Government subsidy to make the enterprise viable. OTA has identified important issues in the following areas:

Foreign policy aims

Data products from Landsat system have been used over the years to advance a number of foreign policy objectives—most notably, preserving the principle of free international flow of information and helping less-developed countries to see our use of space as an opportunity for them rather than a threat from us. Not only have these data and the technologies from which they spring aided other countries in managing and exploiting their own resources, they have served to raise the general level of awareness of growing environmental problems throughout the world. The data from the Landsat system have also provided the United States with access to, and productive influence in, some countries that otherwise strongly disagree with us on certain international political issues. In some developing countries, for example Thailand, Bangladesh and Kenya, their use has even resulted in changes in political and institutional policies and structures.

It is important for the Government carefully to assess these foreign policy advantages before discarding them, and for the Departments of Commerce and State to find imaginative strategies for continuing to use the data to the advantage of the United States in both developing and industrialized countries.

Non-discriminatory access to data

The United States has always sold Landsat data to all puchasers on a nondiscriminatory basis. The data policy of the Landsat program is a cornerstone of the U.S. "open skies" policy and of the principle of using space for peaceful purposes. The non-discriminatory policy has helped the United States to blunt criticism of other activities in space, such as the operation of classified surveillance satellites. The United States has also used this policy to demonstrate to the entire world its adherence to the principle of the free flow of information. Altering the principle of nondiscriminatory data sales by allowing the private sector to set its own data sales policy would be harmful to many U.S. foeign policy interests, not just those involving outer space. However, requiring that non-discriminatory data access be preserved would eliminate a potentially lucrative market for exclusive data or exclusive early access to data, thereby making commercial success more doubtful, or requiring a higher level of Government subsidy.

Value-added services

As I noted earlier, the value-added industry is key to the development of a commercially viable remote-sensing business. Because selling value-added services could be highly lucrative, most bidders for a remote-sensing system would want to control or participate in the value-added business; to forbid the land remote sensing operator to provide value-added services would make transfer less commercially viable. However, many developing countries have expressed concern that if the company supplying the data were allowed to offer value-added services, it might take advantage of having control over the data to make its own value-added services more timely and more complete than those of its competitors. Under such conditions, the company—and its most favored customers—could obtain economic leverage over others, including developing countries that lacked the facilities and personnel capable of interpreting the data. Therefore, from the standpoint of maintaining good relations with developing countries, and expanding the markets for data in these countries, it may be in the best interests of the United States to restrict the private data distributor from entering into the value-added business, or to regulate it closely to prevent such a company from exerting unfair economic leverage over others. As competition from foreign or even other domestic systems grew, it should be possible to relax such restrictions.

U.S. technological leadership

Landsat ground stations in 10 countries constitute an eloquent statement of U.S. leadership in successfully applying high technology for the benefit of all mankind. The United States has also participated with both industrialized and developing countries in pursuing applied research in the uses of the data. It is critical to the continuing R&D of remote-sensing technology, and the growth of the data market, for the United States to maintain strong basic and applied research programs. The United States should also continue its cooperative programs with other countries, both to advance U.S. research objectives and to retain U.S. leadership in the technology of outer space.

International treaties and agreements

The United States helped to formulate and is now party to four major international treaties and agreements that may affect the operations of privately owned remote-sensing systems. Of greatest importance to potential private owners of remote-sensing satellites systems is the 1967 Outer Space Treaty, article VI of which requires "continuing supervision by the appropriate State party to the Treaty." This provision, at the least, suggests some form of licensing and Government-imposed regulations for private space system operators.

Some countries maintain that they should have priority access to data derived from the sensing of their territory; others have argued further that their consent should be obtained before these data are transferred to third parties. These nations are working in the United Nations and other international forums to codify restrictive data distribution practices. Such efforts are likely to intensify if the system is transferred. However, adequate safeguards to prevent the appearance of exploitation of other countries by U.S. corporations could soften or counter international pressures to restrict the distribution of remote sensing data.

Future international coordination

The United States currently participates in several international groups that set or coordinate standards for remote-sensing systems. If transfer takes place, the Government should spell out clearly how private firms would interact with the U.S. agencies having cognizance over these matters.

4. National Security

The military and intelligence communities use Landsat data to support their programs. In fact, they are currently the principal users. So long as both the civilian unclassified programs and the military classified programs are under the direct control of the Federal Government, the activities of both can be coordinated and controlled in the national interest. However, placing remote-sensing programs in the private sector could make it very difficult to continue appropriate coordination between systems and control over data delivery.

It there were no appropriate civilian Government system or sufficient safeguards on a privately owned system, these communities might find it necessary to build and operate their own system, thereby diminishing any expected budget savings, and possibly increasing the net cost to the Government.

Until recently, the ground resolution of the civilian systems has not been sufficient to detect objects of significant military interest. Today, the development of advanced high spectral and spatial resolution civilian sensors in the United States and abroad, and the prospect of private sector entry into the realm of land remote sensing, necessitate a reexamination of U.S. policies regarding technology development and technology transfer. Areas for careful examination include the limits that should be placed on the ground resolution of space-borne sensors, their spectral characteristics, and on sophisticated data processing techniques. However, in the face of the development of advanced foreign systems, it will be difficult for the Department of Defense to exert much control over advances in U.S. systems without making it impossible for U.S. firms to compete in the world market.

Meeting the special requirements of DoD and the intelligence community (if any) for hardening of the system's electronics, and for the system design would cost extra. If the private owner were expected to pay for these additional capabilities data prices would rise significantly and inhibit the market for data. If the Government were to pay for these enhancements, it would constitute an additional subsidy of the system.

5. *International Competition*

As we deliberate over land remote sensing, other countries are developing their own land and ocean remote sensing systems. Canada, France, India, Japan, and the European Space Agency all plan to launch remote sensing satellites by the end of the decade. The West Germans have already successfully flown a test instrument on shuttle flight 7 (the modular optoelectronic multispectral scanner, or MOMS). Three facts are highly significant to the U.S. debate: 1) these foreign system rely (in addition to their own capabilities) directly on experience and technology their designers have gained from U.S. research and development efforts; 2) they are designed to be operational, rather than research and development, systems; and 3) they are being planned with substantial government involvement, including large de facto subsidies. Some of these systems will be directly competitive with the current Landsat system; some will far exceed its capacity to return useful resource data.

For example, since 1978 the French have been planning the world's first commercial remote-sensing satellite service. They expect to fly a series of four satellites, the first of which will be launched in April 1985. The French remote-sensing corporation SPOT Image, and its U.S. subsidiary SPOT Image Corporation, are preparing the sales market for SPOT data. The SPOT satellite will produce data of 20 meters ground resolution in three color bands and 10 meters ground resolution in black and white. I will also have pointable sensors, which will allow it to produce quasi-stereo images.

These countries see the development of remote sensing satellites systems, including systems specifically designed to sense ocean parameters, as an integral part of their emergence as space powers. The United States, though it has a program within NASA to develop new sensors to fly on the shuttle, has no plans to develop civilian operational systems that would provide data over the long term with repeat coverage.

In order to maintain U.S. leadership in applications of space technology to remote sensing, it will be essential for the United States to maintain program continuity, timely data delivery, and affordable data. This will almost certainly require Government subsidy through the 1980s. It will also be important for the Government and the private sector to sustain a vigorous program of research in both space system and the applications of the data such systems supply to the solution of a wide range of terrestrial problems.

CONCLUSION

The Landsat system has over a decade of history behind it, in which the United States has always encouraged the participation of other nations. We have demonstrated that land remote sensing is a powerful tool for resource management and development. For a variety of reasons, including the fact that until recently the Government has not managed the system as an operational one, the market for data has remained small. Because the greatest need for land remote-sensing data is likely to be in other countries (for purposes of mapping and management of remote regions), we can eventually expect the largest market to develop abroad. In the near term, the greatest market is in the United States with the Federal Government. Whether sufficient market for land remote-sensing data will evolve in time will depend as much on the structure of the institutions that are developed as on the inherent capacity of the technology itself.

The terms of transfer should take into account our existing formal international commitments and agreements, as well as our relationships with the international community. Although the decision must be made in domestic terms, it necessarily includes consideration of the international climate, especially the activities of the other space-capable nations. They have already declared themselves ready to compete with the United States in remote sensing.

One of the primary stated reasons to transfer this technology to the private sector is to save the Government money. In the near term, it may not accomplish this. If the safeguards needed in order to reap the maximum benefits in foreign policy and international relations are put in place, subsidies will be needed. Further, the Government will still have to purchase data to support its operational needs at home and abroad.

Finally, if the United States wishes to maintain leadership in this technology, it will be essential that the U.S. remote sensing program, whether publicly or privately owned, remain an integral component of U.S. domestic and foreign policy.

[The following figures and tables are from Remote Sensing and the Private Sector: Issues for Discussion.]

Landsat Data Needs of Foreign and Domestic Users

Agriculture (Federal, State, and private): specific sampling areas chosen according to the crop; time-dependent data related to crop calendars and the weather patterns

Forestry (Federal, State, and private): specific sampling areas; twice per year at preselected dates

Geology and nonrenewable resources (Federal, State, and private): wide variety of areas; seasonal data in addition to one-time sampling

Civil engineering and land use (State, and private): populated areas; repeat data required over scale of months or years to determine trends of land use

Cartography (Federal, State, and private): all areas; repeat data as needed to update maps

Coastal zone management (Federal, and state): monitoring of all coastlands at selected dates depending on local seasons

Pollution monitoring (Federal and State): broad, selected areas; highly time-dependent needs both for routine monitoring and in response to emergencies

Source: Office of Technology Assessment.

TABLE 6.—COSTS FOR SOME LANDSAT DATA PRODUCTS

Product	Cost			
	Until October 1982	October 1982-October 1983	October 1983-February 1985	February 1985-???
Multispectral scanner (MSS) computer-compatible tape (CCT)	$200	$650	$650	$730
Thematic mapper (TM) CTT	N/A	21800	31400	4,400
TM CCT (quarterly)	N/A	750	925	1,350
Color composite image (1:250,000 scale):				
MSS	50	175	175	195
TM	N/A	235	275	290

Source: National Oceanic and Atmospheric Administration.

Table 8.—Customer Profile of Landsat Total Data

	FY 1973[a]				FY 1974[a]				FY 1975			
Customer category	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)
Federal Government (less N.I.'s)	21,780	27%	62,756	27%	28,493	18%	87,156	16%	34,346	17%	169,283	19%
NASA investigators	—	—	—	—	—	—	—	—	5,456	3%	15,992	2%
State/local government	2,995	4%	10,639	5%	2,534	2%	10,920	2%	1,969	1%	16,988	2%
Academic	13,071	16%	28,679	13%	18,611	12%	63,964	12%	27,727	14%	142,054	16%
Industrial	24,430	30%	67,360	30%	35,890	23%	114,140	22%	45,671	23%	219,704	24%
Individuals	5,109	6%	17,143	7%	17,266	11%	67,127	13%	18,643	9%	100,953	11%
Non-U.S.	8,497	11%	28,154	12%	37,038	23%	120,499	23%	47,174	24%	174,659	19%
Non-identified	5,189	6%	13,311	6%	17,346	11%	64,708	12%	17,397	9%	69,376	7%
Total data	81,071	100%	228,042	100%	157,178	100%	528,514	100%	198,383	100%	909,009	100%

	FY 1976				TQ 1976				FY 1977			
Customer category	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)
Federal Government (less N.I.'s)	31,645	13%	253,166	15%	7,771	15%	73,436	16%	21,074	16%	269,825	19%
NASA investigators	63,329	25%	341,056	21%	5,730	11%	48,111	11%	9,827	7%	96,032	7%
State/local government	1,214	1%	8,191	0%	149	0%	1,168	0%	1,360	1%	20,168	1%
Academic	26,077	11%	178,160	11%	8,489	16%	40,129	9%	14,063	11%	141,077	10%
Industrial	42,833	17%	322 699	20%	12,122	24%	121,025	27%	36,979	28%	412,183	28%
Individuals	18,052	7%	141,556	9%	3,755	7%	28,683	6%	8,003	6%	72,129	5%
Non-U.S.	65,100	26%	391,673	24%	13,702	27%	138,632	31%	40,632	31%	442,079	30%
Non-identified	488	0%	4,892	0%	96	0%	1,087	0%	49	0%	344	0%
Total data	248,738	100%	1,641,393	100%	51,814	100%	452,271	100%	131,271	100%	1,453,837	100%

Table 8.—Customer Profile of Landsat Total Data—Continued

	FY 1978				FY 1979				FY 1980			
Customer category	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)
Federal Government (less N.I.'s)	28,020	25%	597,269	30%	31,692	24%	501,214	23%	25,919	19%	392,591	16%
NASA investigators	522	0%	13,431	1%	0	0%	0	0%	0	0%	0	0%
State/local government	1,515	1%	31,557	1%	968	0%	19,281	1%	4,225	3%	78,327	3%
Academic	10,222	9%	159,379	8%	14,742	11%	235,231	11%	12,977	10%	202,401	9%
Industrial	21,321	19%	469,924	24%	25,903	19%	508,792	24%	24,723	19%	614,400	26%
Individuals	5,537	5%	73,808	4%	9,247	7%	102,854	5%	8,147	6%	96,982	4%
Non-U.S.	46,409	41%	630,700	32%	53,912	39%	764,441	36%	58,581	43%	1,003,866	42%
Total data	113,576	100%	1,976,068	100%	137,464	100%	2,131,813	100%	132,572	100%	2,388,567	100%

	FY 1981				FY 1982				FY 1983			
Customer category	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)	Items	Item (%)	Dollars	Dollar (%)
Federal Government (less N.I.'s)	29,177	22%	481,067	19%	24,000	20%	571,807	20%	29,804[b]	47%	5,269,741[b]	75%
State/local government	3,470	3%	107,667	4%	5,251	4%	146,897	5%	1,268	2%	70,263	1%
Academic	11,401	9%	198,611	8%	7,753	7%	201,577	7%	2,536	4%	210,790	3%
Industrial	29,821	22%	758,245	31%	23,078	19%	924,540	31%	6,341	10%	632,369	9%
Individuals	9,292	7%	117,642	5%	5,953	5%	126,565	4%	1,902	3%	70,263	1%
Non-U.S.	49,965	37%	832,038	33%	53,964	45%	969,893	33%	21,560	34%	772,895	11%
Total data	133,126	100%	2,495,268	100%	119,999	100%	2,941,279	100%	63,413	100%	7,026,895	100%

[a] Landsat imagery only—no CCT customer profiles available for 1973 and 1974 (minimal data).
[b] Includes special acquisitions and acquisition charges.

SOURCE: National Oceanic and Atmospheric Administration.

Figure 8.—Deliveries of Landsat MSS Data to Federal Users by NASA-GSFC and DOI-EDC

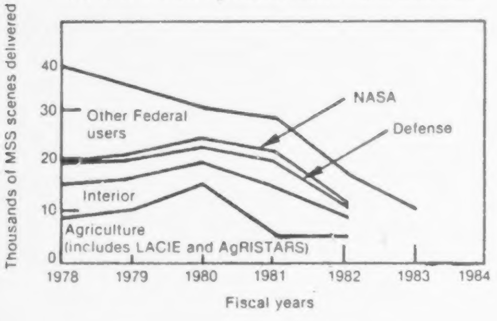
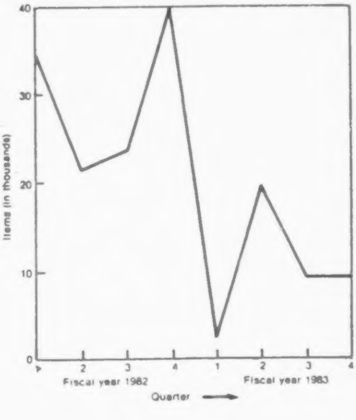


Figure 9.—Quarterly Sales of MSS Imagery and Digital Frames (total sales, including non-Federal and foreign customers)



[The following information was subsequently received for the record:]

QUESTIONS OF THE MINORITY AND THE ANSWERS THERETO

Question. In your report, you indicate that the "principal reasons for transferring remote sensing services to private hands are that the private sector excels both at *innovation* and at developing markets . . . Another reason for transferring these services to the private sector is the hope of reducing federal expenditures."

In your opinion, if the "total cost" of transferring Landsat to the private sector is estimated, and I assume this estimate would include any expenses incurred by the defense and intelligence community for additional remote sensing capability, will the federal government save any money? Should the driving force towards commercialization be budgetary or in terms of the technological development that could result from a private sector program?

Answer. Costs, at least for the first few years of private ownership, are likely to be higher than the Government now incurs. In later years, if the transfer is successful, costs to the Government could be much less. However, this question cannot be answered quantitatively until the proposals submitted by the private sector is response to the request for proposals are examined and the Congress decides what requirements and conditions it wishes to impose on the private sector operator. The United States now spends about $35 million per year for operations and maintenance, a sum which does not reflect the capital cost of the system, nor the costs for continued research and development.

The major factor affecting the amount of subsidy required under private ownership is the rate at which the market for data can be developed. If the market can be expanded relatively quickly, the amount of subsidy required for to sustain a profit-making corporation will decline at a similar rate. We have suggested it might take as much as 10 years to develop sufficient market, but the future market is very uncertain. Until strong marketing efforts are tried, we will have little on which to base projections. We might find, for example, at the end of a decade of trying, that the market still had not developed sufficiently, but there is enough public benefit to continue anyway with a subsidized system.

The most important concern in generating a market is the price of data. As our analysis of the sales of data from the EROS Data Center show, at current data prices, the private sector is unlikely to be able to generate sufficient market *even if it were able to deliver data promptly and continuously.* Nor can the private sector support its operation at the current levels of sales. In fiscal year 1983, NOAA sold only 42,000 items of MSS data. The previous year, when prices were much lower, the EROS Data Center sold nearly 120,000 items. In order to reduce the price of data, in the long run, the private sector will have to increase the volume it can sell *and reduce dramatically the cost of the entire system, including the data distribution system.*

Several other factors would also affect the amount of subsidy:

Defense and intelligence requirements. Some of these requirements are classified and would require a classified answer. Any new hardware specifications not already required by civilian operations would dictate extra subsidy (see the classified addendum to the RFP for details). In addition, maintaining the extra manpower necessary for coordinating with the military and intelligence community would cost extra.

Maintenance of archives. The EROS Data Center now maintains an archive of Landsat data. Senate Bill 2292 requires the Government to continue to maintain an archive. Although OTA feels that it is critical to the public good to continue archiving data from Landsat and any follow-on system (see the answer to question IV), transferring the operation of the system to the private sector is unlikely to save any money for this function.

Foreign ground stations. The Government now charges $600,000 per ground station (for 10 foreign ground stations) for the right to receive data from the Landsat system. When the current memoranda of understanding with these ground stations expire, this revenue, which in part offsets the cost of the Landsat system, would be lost to the Government. Still, the private firm could derive income from licensing these stations to collect and distribute data.

Oversight of the private operations. It will still be necessary, at least in the early years, to maintain sizeable Government staff to oversee the operation of the private sector system to assure that it meets Government and other public needs.

The driving force towards commercialization should not be budgetary concerns but rather the potential advances in the system's technology that could derive from private ownership. In our opinion, advances in the critical areas of product design and data delivery may be more important than new sensors.

In all of this, we must not lose sight of the potential cost of not having a civilian system at all if the transfer process were to fail. As we noted in the Technical Memorandum, if there were no adequate civilian system, the military and intelligence communities might decide to mount their own system. In addition, private customers and some civilian Government agencies would be forced to purchase data from the French SPOT system.

Question. In your opinion, does S. 2292 contain the safeguards required to protect the U.S foreign policy and international relations concerns that are highlighted in your report? If such safeguards are included in a bill, what affect will this have on the likelihood of a commercial success?

Answer. With the possible exception of the provision concerning the value-added business (section 305—discussed in the answer to question III), S. 2292 does seem to contain sufficient safeguards to protect U.S. foreign policy and international relations. As other testimony at the hearing indicated, these safeguards are likely to inhibit the commercial success of a private system, at least in the short run. These safeguards are particularly necessary as long as the commercial operation is essentially a monoply. In the long run, however, as the technology begins to be incorporated into the fabric of international commerce (as satellite communications are today) such safeguards will become unnecessary. In other words, the competitive marketplace would make it possible for potential customers to seek alternative sources if one company is unresponsive to their needs. Therefore, including such provisions in the bill is likely to protect our foreign policy interests, but is also likely to require a higher subsidy until the market develops sufficiently to allow market forces to dominate.

Question. As for the private sector's marketing ability, would you please indicate for the record the type of competition for markets that a U.S. firm is likely to encounter in the remote sensing business? Can a private sector firm compete effectively with a program supported by a foreign government such as France or Japan?

Answer. The U.S. firm will likely encounter aggressive sales competition, especially from the sale of SPOT data. For example, the SPOT Image Corporation, a U.S. subsidiary of the French corporation, SPOT Image, has prepared the groundwork for selling its future data from space by marketing data products accumulated during the SPOT Simulation Campaign from aircraft flown over selected areas of the United States. Customers from private industry and Government purchased these prototype data sets. The results of that campaign will be better known in May when customers report publicly on their applications of the data. What is clear so far is that the French have put marketing first in their operating plans, because they are convinced that the key to establishing a viable commercial business is a strong marketing effort.

The United States, in developing the technology for land remote sensing, has already subsidized any private sector entrant to a considerable extent. The U.S. private sector could compete effectively with foreign government programs (e.g. SPOT) *if* it continues to receive support from the U.S. Government, especially in the early years. Subsidy may also be required in later years if the foreign governments continue to subsidize their national systems, or if military and intelligence requirements on the system are sufficiently stringent.

Question. Finally, the existing arrangement between the U.S. and each foreign ground station—the annual charge of $600,000 and a fee for each data product sold—seems to create an incentive for the marketing of Landsat data. Would you please comment on the success to date of foreign station data sales and their marketing capabilities? Are not these foreign ground stations likely sources of competition for a commercial marketing program?

Answer. The foreign ground stations are owned and operated by governments. Most of the data they distribute are not sold but are given to a variety of government agencies. At the present time and with their present structure they are not likely to be sources of competition with a private owner. In fact, insofar as their efforts help to generate the market for data, they could aid the marketing efforts of a private corporation.

Question. A major concern addressed in your testimony was the worry among data users that the transfer of the Landsat program to the private sector would result in no U.S. system at all after Landsat 5.

What options exist whereby the federal government can insure "data continuity?" For example, should a Landsat D" be developed? Should Landsat 4, if technically feasible, undergo on-orbit repair in a future shuttle mission? Should a "small-isbeautiful" system be readied as a fallback? Or should we permit a foreign supplier to fill any possible data gap?

At the same time, if the U.S. transfers the Landsat system to private hands, how will this affect U.S. participation in international organizations such as the Landsat ground station operators working group and the coordination on land observing satellites?

Answer. OTA is not in a position to judge whether repair of Landsat 4 is economically feasible. The Government could build and fly a Landsat D" in order to ensure continuity of data flow. The design of such a satellite and its sensor package would be crucial, however. Under current market conditions for data, the cheapest and perhaps most reasonable sensor to fly is not another version of Landsat 5 which contains both MSS and TM sensors, but one that carries simply the current MSS sensor. Although that technology is over 10 years old, it is reliable, relatively inexpensive, and the users already know how to put the data to effective use. Furthermore, it could be constructed in a relatively short time. Such a satellite would not satisfy those users who are anxious to have higher resolution data and a greater number of spectral bands, though is would serve the majority. This strategy would give the private sector time to design and build a more advanced satellite while the customers continue to experiment with the thematic mapper data from the existing Landsate 5 to determine their real needs.

Alternatively, a Landsat D", although more expensive and perhaps more time consuming to construct would also allow the United States to dominate the low end of the data business and also serve users willing to pay for higher resolution and more spectral bands. It would give U.S. suppliers sufficient time to build a strong customer base for using data of greater capability when they become available from the new sensors. Either an MSS-only satellite or Landsat D" would undoubtedly lose some business to the French SPOT system, but some customers will wish to purchase SPOT data anyway because those data are expected to provide quasi-stereo images and higher resolution than the thematic mapper. Yet, allowing all our data needs to be met by a foreign supplier for a period of time when the U.S. had no satellite up would clearly inhibit the overall U.S. market for land remote sensing data.

U.S. participation in the Landsat Ground Station Operators Working Group and the Coordination on Land Observing Satellites need not be affected by private ownership. Yet, under the terms of the RFP, the Government is dependent on the private owner to suggest how it will interact with such groups. This appears to place too much power for affecting U.S. policy in the hands of the private sector.

Question. During your oral testimony, you indicated that the value-added provisions in S. 2292 could be cause for concern for foreign value-added companies.

For the record, could please detail the potential affects of the antitrust provisions in S. 2292 upon a foreign value-added firm?

Answer. OTA's concern is more for the foreign *countries*, particularly the developing countries with little ability to process data quickly, than for the foreign value-added companies. The anti-trust provision (section 305) is probably sufficient for the value-added industry in this country. However, we are concerned about the *perception* created in other countries by transfer of the system to private hands. Those countries are particularly worried that a large private corporation might obtain access to resource information about them long before they could obtain such information themselves.

The United States earlier successfully assuaged the fears of the developing countries over civilian remote sensing by establishing the non-discriminatory data distribution policy, and by offering assistance in learning how to use the data. If those countries *perceive* that a private firm is attempting to take advantage of them by preferential treatment of its own value-added subsidiary, then those countries could raise problems for us in international forums such as the United Nations. They might even attempt to do so in international organizations that have no direct connection to remote sensing, but do have responsibility for some space matters, such as the International Telecommunication Union.

In the early days of the transfer arrangement, it might be appropriate for the Government to add an additional subsidy to allow the system's owner to concentrate on developing a market for raw data while preventing its entry into the value-added business. For example, the firm could build its own specialized market establishing a broader base for the value-added business by offering a range of intermediate data products (e.g. smaller scene size, data on floppy disks suitable for microcomputers, etc.). Then later, as a competitive international industry is established, the company could enter the value-added business with less concern from other countries.

Question. During your testimony you also noted that section 602 of S. 2292 should require the establishment of a cloud free data set.

Would you please indicate the pros and cons of establishing a cloud free set of data? Who would be the principal beneficiaries from the creation of such a data set? What are the costs of compiling a cloud free data set?

Answer. By establishing a global cloud-free archival data set, we would store for later retrieval the baseline data set (as of the 70s and early 80s) from which to observe, study, and evaluate future changes on the Earth's surface. Anyone that needs an historical data set would find such an archive of use—scientists studying large-scale changes such as deforestation and desertification, resource planners and managers, mineral explorers, and geographers, to name a few.

Perhaps the most important uses to which such a data set could be put are still unknown. Scientists still have much to learn about large scale surface phenonomena. As research proceeds, the data set will serve as a unique and irreplaceable record of Earth's surface during the 1970s and early 80s. We are not in a position to estimate how much it would cost to establish a cloudfree (or nearly cloud-free) archival data set.

Senator GORTON. Thank you, Mr. Williamson.

Mr. Spann.

Mr. SPANN. Thank you, Mr. Chairman.

My testimony today is very positive, which I guess places me a little bit in the minority here but I firmly believe the following: That commercialization is a marketing problem and not a technology problem; that it is possible to commercialize the U.S. land satellite remote sensing program and save the taxpayers money, and that the major reason that the current Landsat program is not viewed as commercially viable is because the Government has not equipped itself to make the program a commercial success. I will explain the reasons for my optimism in a moment.

Since my testimony today differs somewhat from what you have heard and may hear, I have provided some background information in my written testimony. I have done this so that you will appreciate the specific market orientation of my previous work. I have done considerable work for both Government and private clients. I feel that the background information is necessary to establish the nature of my perspective on commercialization.

My opinions are based on many years of analysis of the commercial aspects of land satellite remote sensing, and I might add that when the list of the bidders was read, I noticed that I have provided at one time or another, market data to five out of the seven bidders.

It is my contention that the current Landsat program is not commercially viable because the Government has not equipped itself to make a commercial success of the program. This does not imply that the sunk costs in R&D can be recovered. It does imply that the current data sales can be made profitable enough to support all operation and maintenance costs, plus provide adequate profits for constructing new satellites. These satellites will be designed on the basis of market needs.

There are two fundamental requirements for the commercial success of any product or service. First, the supplier organization must have some protection for the output of its efforts. Second, it must have a marketing program that focuses on real needs and addresses the segments of the market that are willing and able to pay to have these needs satisfied.

In the case of the current Landsat program, neither of these requirements has been met.

The practice of tape copying is and always has been widespread in this country. It has been mentioned by others, and I just want to say that this practice renders the EROS Data Center sales statistics meaningless as an indicator of the true market for Landsat data. Furthermore, the situation is not going to change without a new Government policy toward data reproduction.

The second deficiency in the current program from a commercialization standpoint is the lack of a marketing program. The Government has never chosen to market Landsat data actively to those segments who are both willing and able to pay for the data on the basis of its value to them. The French have certainly not ignored marketing as part of their SPOT program. Their marketing program was begun 2 years in advance of the launch of SPOT.

Obviously, a marketing program is not independent of having copyright or some similar protection for the data. It does little good to create a market for your product if a competitior can then buy your products from you and sell them for less than you are charging.

In commercializing the U.S. land remote sensing satellite program, the Government cannot dictate the technology to be used or the data to be produced. If the Government dictates these parameters, the system is not commercial. By definition, a commercial program is market driven. Hence, the commercial operator must be free to provide the types and qualities of data demanded in the marketplace.

For example, there is currently debate as to whether thematic mapper or multispectral scanner should be the baseline for the commercial system. In reality, it should be neither. The commercial operator should be free to offer whatever data meets the requirements of the most customers in a cost-effective manner.

More than 2 years ago, I published a satellite remote sensing market forecast which included data, services, and equipment and software. Land satellite remote sensing data alone was forecast to approximate $100 million by 1990. Events since then have made me believe that the forecast was very conservative.

It is my understanding that the U.S. Government has spent more than a billion dollars on land remote sensing satellite activities. At this point, the biggest risk to the Government is that U.S. industry, for the most part, will derive few benefits from previous expenditures on Landsat. If Congress does not act quickly to support Landsat commercialization, this $1 billion may have been spent to further the commercial interests of foreign countries only.

In summary, let me say that the only current reality is Landsat. All other satellites represent a future promise. To the extent that commercialization can be completed quickly, current customer loyalties can be reinforced and new customers acquired for the U.S. system.

[The statement follows:]

STATEMENT OF G. WILLIAM SPANN, PRESIDENT, METRICS, INC.

Mr. Chairman and Members of the Committee, my testimony today is very positive. I firmly believe the following: First, Commercialization is a marketing problem and not a technology problem; second, it is possible to commercialize the U.S. land satellite remote sensing program and save taxpayer's money; and third, the major reason that the current Landsat program is not viewed as commercially viable is because the government has not equipped itself to make the program a commercial success.

I will explain the reasons for my optimism in a few minutes.

Since my testimony today may differ from some of what you have heard and will hear, I believe that I should give you some background information. I have been involved in the Landsat program since 1972 when I worked at the Engineering Experiment Station at the Georgia Institute of Technology. I have conducted user needs surveys and prepared market forecasts for NASA and NOAA. I am presently a member of the Space Applications Board, Committee on Practical Applications of Remote Sensing from Space. My expertise is in the area of markets—commercial markets—for land remote sensing satellite-related data, equipment, and services.

In 1975 I published the *Remote Sensing Market Survey*, interpreting the results of my privately financed market survey. This was followed in 1977 by *International Remote Sensing Activities*—a world-wide evaluation of the use of remotely sensed satellite data. In 1979 I published the *Landsat Remote Sensing Market Forecast, 1979–1990*. This publication forecast the market for Landsat data, equipment, and services through 1990. It was based on an analysis of historical trends and anticipated future events. This was subsequently updated and broadened to include the possibility of other satellite sensors in 1981 in my *Satellite Remote Sensing Market Forecast, 1980–1990*. All of these forecasts have been sold to multiple commercial clients world-wide.

In addition to the above, I have conducted numerous market studies for private clients who are interested in the commercial aspects of land remote sensing satellite systems. These studies have included the evaluation of digital image processing equipment and services markets, forecasts of the potential market for stereoscopic satellite data, and the feasibility of a commercial venture to obtain imagery from orbiting camera systems. All of these studies have focused on markets and future market potential.

The above comments are intended to relay the nature of my experience so that you will appreciate the specific *market orientation* of my work. You will also notice that I have done considerable work for both government and private clients. I feel the above background information is necessary to establish the nature of my perspective on commercialization. My opinions are based on many years of analysis of the commercial aspects of land satellite remote sensing.

It is my contention that the current Landsat program is not commercially viable because the government has not equipped itself to make a commercial success of the program. This does not imply that the sunk costs in R & D can be recovered. It does imply that current data sales can be made profitable enough to support all operation and maintenance costs plus provided adequate profits for constructing new satellites. In all probability these new satellites would use solid state technology (as SPOT has done) to decrease costs and increase reliability. Furthermore, they will be designed on the basis of market needs.

There are two fundamental requirements for the commercial success of any product or service. First, the supplier organization must have some protection for the output of its efforts (copyright, trademark, patent, etc.). Second, it must have a marketing program that focuses on real needs and addressess the segments of the market that are willing and able to pay to have these needs satisfied. In the case of the current Landsat program, *neither* of these requirements have been met.

At present there is nothing to prevent me from buying a Landsat scene on digital tape from the EROS Data Center for $650. I can then copy this tape as many times as I choose and resell it to all interested parties for, say, $200 each. If I am able to find 10 people to buy my tape copies, I make a profit of more than $1000 on this scene and the government loses over $5,000 in revenue. The data that my customers receive is every bit as good as that available from the EROS Data Center. Consequently, there is no reason for them to purchase data from EROS if they know of my service.

The practice of tape copying is and always has been wide spread in this country. Much of it is not done for profit but simply as a favor to a friend or as a swap for a different scene. Nevertheless, this practice renders EROS Data Center sales statistics meaningless as an indicator of the true market for Landsat data. Furthermore, the situation is not going to change without a new government policy toward data reproduction. No private operator is likely to consider commercializing the Landsat system without some assurance of copyright or similar protection for the data.

The second deficiency in the current program from a commercialization standpoint is the lack of a marketing program. The government has never chosen to market Landsat data actively to those segments who are both willing and able to pay for the data on the basis of its value to them. The French have certainly not ignored marketing as part of their SPOT program. Their marketing program was begun more than two years in advance of the launch of SPOT.

Obviously a marketing program is not independent of having copyright of similar protection for the data. It does little good to create a market for your products, if a competitor can then buy your products from you and sell them for less than you are charging.

In commercializing the U.S. Land Remote Sensing Satellite Program, the government *cannot* dictate the technology to be used or the data to be produced. If the Goverment dictates these parameters, the system is not commercial. By definition, a commercial program is *market-driven*. Hence, the commercial operator must be free to provide the types and qualities of data demanded in the marketplace. For example, there is currently a debate as to whether Thematic Mapper or Multispectral Scanner data should be the baseline for the commercial system. In reality, it should be *neither*. The commercial operator should be able to offer whatever data meets the requirements of the most customers in a cost-effective manner.

In the short run, the geological community consititutes the largest market and has a clear need for Thematic Mapper data. The need for satellite data for geological purposes is generally a one-time or seasonal need. If Landsat 5 completes its design life, the needs for Thematic Mapper data may be satisfied. A commercial operator offering Thematic Mapper data on a second satellite *might* find little market for it.

The renewable resources community will ultimately determine the success or failure of a commercial land remote satellite system. At the present time, however, this is a very small market. It will take much time and effort to develop it. Except for timeliness, Multisprectral Scanner data have served many of the needs of this market sector.

We cannot conclude from these examples that either Thematic Mapper or Multispectral Scanner data should be the baseline commercial system. The commercial operator *must* be free to propose sensors that meet the needs of those currently willing and able to pay for data. At the same time, the commercial operator must be free to develop the renewable resources market and provide data that is useful to this market.

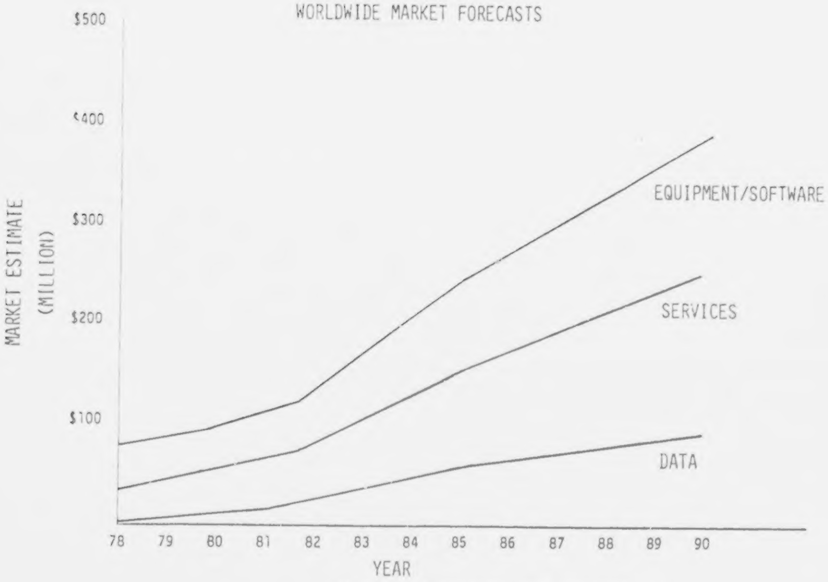
More than two years ago, I published a *Satellite Remote Sensing Market Forecast* which included data, services, and equipment/software. Land satellite remote sensing data alone was forecast to approximate $100 million by 1990. Events since then have made me believe that the forecast was very conservative. A pictorial summary of this forecast is attached to the end of my testimony.

It is my understanding that the U.S. government has spent more than $1 billion on land remote sensing satellite activities, including education, training, technology transfer, and applications programs. Much of the education and training abroad was funded by the U.S. through the U.S. Agency for International Development and contributions to the United Nations, World Bank, and other organizations. This money and effort has helped to build a tremendous world-wide infrastructure of organizations capable of using satellite data. METRICS has identified *more than* 2000 organizations outside the U.S which are interested in Landsat data.

At this point, the *biggest risk* to the government is that U.S. industry, for the most part, will derive few benefits from previous expenditures on Landsat. If congress does not act quickly to support the Landsat commercialization effort, this $1 billion of U.S. funds may have been spent to further the commercial interests of *foreign countries* only.

In summary, let me say that the *only* current reality is Landsat. All other land remote sensing satellites merely represent a future promise. To the extent that commercialization can be completed quickly, current customer loyalties can be reinforced and new customers can be acquired for the U.S. system. The organization with the *best marketing program* will capture the majority of world-wide land and remote sensing satellite data sales. In this respect the government has an opportunity to give a U.S. company a large *headstart* on any foreign competition.

I firmly believe a U.S. land remote sensing program can be made commercially viable *provided* someone is granted copyright or similar protection for land satellite data *and* devises a marketing program to address commercial opportunities.



MARKET ESTIMATES BY TYPE OF PURCHASE

METRICS

ATLANTA

(C) 1981

Senator GORTON. Thank you.

Dr. Sheffield.

Dr. SHEFFIELD. Thank you.

Robert Porter sends his apologies. He had an accident at home. He is recuperating, but immobile.

I would like to offer a few comments on his testimony. And I would like to begin with one of the few facts of the Landsat program. The Landsat program is surfeited with words and opinions but there are very few facts. One obvious fact is that the present system is not self-supporting.

We have to ask ourselves, Why then have certain groups chosen to bid for the commercialization of Landsat? And the answer has to be, that we all believe a self-supporting system can be created, and will be created; but it will not happen unless two things are done. First we have to expand the user base. The present user base, the people who buy from the EROS Data Center, are the sophisticated users. No one has managed to reach the other 99 percent of potential users. They can be reached, but they must be reached through what are usually called the value-added service companies.

I would like to give my own opinion, that the full market will never be reached as long as the Government is in charge of the program. Government programs do some things very well, they do other things less well. One of the things that Government typically does not do well is to move rapidly into new areas, to move aggressively, and be poised to capture explosive growth when it can occur. That is not the Government pattern.

I do believe, agreeing with Mr. Spann, that the commercial potential is there, but I do not believe it can be achieved unless we move the program to industry. And that gives this paradox: You cannot prove that the markets are there unless you move it to industry. So any suggestion that we will leave it in Government, wait until the market develops, and then move it to industry, is self-defeating.

I would like to insert a comment here. Much has been said about the use of foreign satellite data. I believe that is something we must look at very carefully indeed. If you want to undermine a U.S. commercialization program, one way to do it is to decide that charity does not begin at home; it begins elsewhere. And you then look for your data in the French program and the Japanese program. I think that is a great mistake, and I think that although we must be prepared to look at foreign data sources, we must do so in the context of U.S. needs and priorities.

My second requirement, if the program is to be commercially successful, is to remember that we do not operate in a static and fixed environment. We can absolutely guarantee increased competition from abroad in the remainder of the 1980's and the 1990's. We are looking at an embryonic technology. The question of MSS versus TM, already raised here, is the wrong question. Those are both primitive instruments. We must be looking beyond that, to see what will be developed by the year 2000.

And for that long-term development, we absolutely must have Government research and development.

Industry cannot afford, nor is it appropriate that it attempt to undertake the basic research in remote sensing technologies. Those should come from Government, and universities. They are part of the general thrust for improved technological leadership by the United States.

Given a Government thrust toward better technology, and given industry opportunity to reach that expanded market, I believe that the potential is huge. I believe it will be achieved, but not instantly. And any program which the Government decides to support must accept that this is not a fully developed technology. It is not a working gold mine, simply being turned over to industry operation.

Rather, it is a fledgling industry. Government should be very concerned that in commercializing this fledgling industry, the necessary supports and guarantees are made at the Government end, to allow the industry to finally achieve what I consider to be its enormous potential.

Thank you.

[The statement follows:]

STATEMENT OF J. ROBERT PORTER, JR., PRESIDENT, EARTH SATELLITE CORP.

Chairman Gorton, members of the Subcommittee on Science, Technology and Space. I am speaking to you today from the position of one in the value added service business, and as a potential subcontractor associated with the Hughes/RCA team. I would like to make three points.

Point One. The present Landsat system cannot be made into a self-supporting commercial venture within the near term! The user infrastructure does not exist. The distribution system does not exist. The application models to utilize the data are not adequate for most users. Further, the development of all these has been inhibited by the uncertainty of the government program to date and the early problems with Landsat-4. Consequently, there must be a transition to a commercially useful operation, a transition the price of which industry cannot bear alone. Stated otherwise, government is not giving commercial groups a gold mine—they are not even giving them an exclusive concession—rather they are inviting them to go out and search for one themselves.

Point Two. Spacecraft data is only of value to people who know how to convert it into useful information. In that sense, the user must provide value-added services. Recently at a Landsat-D' launch user symposium one of your former colleagues, Harrison Schmitt, asked the question of a panel, "How much *under-priced* would you say current Landsat data is?" The answer to that question is, "The value depends on the use and the sophistication of the user."

The situation today can be characterized as follows. Imagine a triangle which is divided in three parts. The tip of the triangle characterizes the most sophisticated users such as the large oil companies; these users have had enough experience in developing exploration models to know how to learn much from the data they purchase. Numerically, this is the smallest group of users, but this group *may* be willing to pay more than current Landsat prices because of the value *their* analysis adds. The middle of the triangle includes the second smallest area and represents users who have added some value through their own experience in utilizing the data and/or have obtained assistance from others who have helped put it into a useful format for their purposes. The base of the triangle represents the new user of the data, or the beneficiaries of information derived from the interpretation of data which they have never seen. This area represents the largest number of users. For them, Landsat data is currently over-priced. Today, Landsat data is *over-priced* for the numerical majority of the market!

In order for the program to be truly commercialized, and in order for the public good to be served, the base must be broadened. The best way in my opinion to broaden this base is to somehow add more value to the raw data. What are some ways this might be done?

First, better distribution and/or easier access to data. For example, a crop assessment organization cannot wait three weeks for its data.

Second, better sensors which meet the requirements of a larger number of users. For example, providing better spatial and spectral resolution.

Third, lower prices and/or the sale of subscenes would make Landsat data attractive to a great number of users.

Fourth, better applications model development which is stimulated by more in depth study by experienced users, the exposure of more data to new users, and more involvement of academic and corporate perspectives.

Fifth, "custom coverage" to meet specific user requirements. For example, user ability to specify spectral bands, collection times, look angles, and the option of stereo coverage.

In summary, there is much a commercial entity can do consistent with non-discriminatory distribution which will help user market obtain more value and profit from the data.

Point Three. Finally, if commercialization is going to succeed, the way must be paved by the full utilization of *current* technology. I serve as a director on the GEOSAT Committee, a member of the Halbouty Committee, and as a member of the Space Applications Board of the National Research Council. If there is one message I have heard loud and clear from my colleagues in each of these groups it is that we want continuity of *progress,* not continuity of *old data* or instruments.

Finally, I would like to comment on your proposed legislation. On the one hand, it sounds reasonable that the government should continue to conduct R&D. I support this *in principle.* What must be avoided *in practice* is the possibility of the R&D constituting, in fact, a basis of competition with industry. Remember that products from Landsat-1, 2, and 3 were all marketed widely even though they technically were considered R&D. Another similar area of concern is Sec. 403 which refers to joint government-industry programs. While your bill addresses the problem of competition, its lack of definition leaves latitude for interpretation. Lastly, one should consider the other side of the coin; how does one rapidly disseminate true R&D data into the public domain and emphasize non-discriminatory distribution? Perhaps this could be resolved by making appropriate R&D data products available for distribution through the selected entity subject to the submission of a satisfactory distribution plan. If that plan was judged to be inadequate, then alternative plans could be solicited from industry.

Thank you.

Senator **Gorton**. Thank you. Each of you has studied various aspects of transferring land remote sensing to the private sector. And as a consequence, most of these questions at least are addressed to each of you to answer in turn.

S. 2292 states that contractors for both marketing of Landsat data and development of a followon system can engage in value added activities only in accordance with the antitrust laws of the United States. This means that the contractors would have to set up separate subsidiaries, with no competitive advantages in order, legally, to enter the value added business.

Do you feel that this provision would provide a healthy value added industry, or that it would restrict it unduly?

Dr. **Williamson**. We believe, insofar as the U.S. industry is concerned, that the provisions of the bill appear adequate.

These two other gentlemen can answer better than I, since they are actually in the business.

However, we do have the concern—and it is a concern that we believe should be explored a little bit further—as to whether the bill's provisions with respect to antitrust are sufficient for other countries, especially developing ones, who might fear misuse of the data by the U.S. owner. Those countries might fear U.S. antitrust laws are inadequate to prevent the U.S. owner from taking special advantage of its control over the distribution process to give prior access to favored customers who could then process the data and learn about a country's resources before the country could itself. There may be ways, in fact, to alleviate those fears by making sure, for instance, that the Federal Government give adequate support in terms of the kinds of international programs that AID has had in the past. That might help. But we do believe that the value added provision deserves further consideration.

Mr. **Spann**. I am not in the value added business. My business is market research. I do not believe that however it is structured, the system operator should be precluded from being in the value added business. However, I do not believe that being the system operator automatically gives you a particular advantage over other competitors.

Let's face it; the market is such that it requires so many people with so many diverse skills, that no single company is going to possibly be able to cover more than a very, very small number of the bases that are available in the value added world.

Dr. **Sheffield**. I think that using the term "value added industry" tends to confuse. It is not an industry; it is a thousand industries. And for any single operator to try and capture all those, and move into every one of them, would require that they hire most of the work force of the United States to do it.

The best way for the operator to proceed is to stimulate all the value added industries possible, because they represent the outreach to the final users. Otherwise it would be like a computer manufacturer deciding that they will run all the applications of computers on their own computers. The logical thing to say is, let everyone else provide those value-added services, and let us work with them. I think that any operator would benefit from stimulating all value added service industries, rather than attempting to replace any of them.

Senator GORTON. Mr. Spann, especially, is optimistic about the market development. Other people we have heard from are not.

All of you have studied the prospects for private remote sensing ventures. Would you summarize for me your views on how fast, how quickly, the market can develop? And comment in the context of the framework provided for market development in S. 2292.

Mr. SPANN. Well, I am afraid how fast is quite relative. It depends on the resources available to the people that are trying to develop the market, and the legal structure under which they can operate. The market has not been operated in a commercial mode in the past, and probably the biggest time lag is going to be in terms of the market itself adjusting to a new mode of operation; that is, being a commercial market rather than being a very, very highly subsidized Government data market.

Take copying as a perfect example. The tapes have been widely available to anybody who wanted to either talk to a friend or pay essentially for the cost of a little computer time and another magnetic tape.

It is going to take the market a little time to adjust. I would say certainly within 2 years, the market will have completely adjusted. The penetration of the various different market sectors depends on their own relative level of data use and the capabilities that they bring in terms of their own analysis of the data. The geological community is by far the most advanced, and would be essentially in a commercial mode immediately. The renewable resources community and in particular some of the State and local governments would take the longest to adjust to what we are calling commercialization here.

Dr. SHEFFIELD. I would like to make a comment. I think it is very difficult to talk about the speed of market development. I think a more interesting question is perhaps what is the final size of the achievable market? How fast you get there depends on how you proceed to do it, but if it turned out that we believe that the final potential market is only $20 million, it would become academic about how fast one could capture it. So the real question is, how big is it?

My own conjecture is that we are looking at a market which is a billion dollar enterprise by the year 2000. And the other point I want to make is, we are setting precedents at the moment which will extend for a very long time. The market which will exist or fail to exist by the year 2000 very much depends on how it is allowed to grow. And for that reason, the key decision—which is, are we to leave this program as a Government program, are we to leave it as mixture of private and public, or are we to move it to industry? That decision will decide the speed, and will decide how much of the very large potential market is captured 20 years from now.

Dr. WILLIAMSON. I would have to agree with the views of both these gentlemen. Dr. Gibbons stated in his written statement that a market sufficient to support a commercially viable operation might not occur for about 10 years. It might occur sooner; it might occur later.

However, I believe in order to determine whether it will occur or not will take some time after the system is transferred to the private sector, if it is, to see how the private sector actually makes that market develop.

Only then will some fairly accurate market projections be able to give us a sense of when a sufficient market might occur.

Senator **Gorton**. Dr. Williamson, OTA is to be commended for so thoroughly analyzing the issues and problems related to private operation of these remote sensing systems. Of all the issues discussed in the OTA study, can you single out one or more that may not be adequately addressed in S. 2292?

Dr. **Williamson**. We have a couple of issues which, from one point of view, might appear fairly minor, but we think they are pretty important. One is the issue of research in the universities. As we understand it from talking to the university personnel themselves, their programs in remote sensing are very small right now. They have been much larger, due mainly to research grants from NASA.

However, we view the universities as an important factor in the process of technology transfer from the Government into the private sector. They are one part of it. Of course, the value-added industry is probably the largest factor in such technology transfer. But the universities interface with the value-added industry as well. So that is one item that might be addressed in the bill—making some provision for university research funds.

Another one that we have suggested is in the provision for the archive in section 602. We think it is important for that archive to establish a global data set. As we understand it, none yet exists in the archive, and it would be very useful for future research and as a baseline for any other work in land-remote sensing.

Thank you.

Senator **Gorton**. Mr. Spann, Dr. Sheffield, you both have looked at this from the point of view of market prospects. I would like to hear your comments on issues that should be addressed more precisely or better in this legislation.

Mr. **Spann**. Well, I do not pretend to be an expert on the legislation, but let me say one point that sort of jumps out at me is the provision for allowing one entity to commercialize a system and another entity to market the Landsat data.

I believe it is essential that, whether they are just licensed to market the data, or whatever legal provisions are made for this, that they be allowed to market the Landsat data, not just in this country, but worldwide, in order to give them a substantial advantage over the foreign satellite competition in developing customers and developing markets.

It is ultimately going to be the organization with the best marketing program that wins out in this worldwide satellite race. And, as I stated in my testimony, the only current reality is Landsat. Everything else is just a future promise.

Dr. **Sheffield**. I would like to point out an ambivalence in most of the speeches and writings on this subject. It really needs to be resolved, I believe, by the House and Senate and by the Government, before a rational decision can be made.

The ambivalence is this: People do not seem able to make up their minds whether this is an enormously valuable program to the United States, which must continue in some way, whether it be in

Government or industry, but is in any case absolutely vital. That is one possible view. The other view is, here is a program which does not look as if it makes any money, and which costs us some money, and we do not know what to do with it. So why don't we let industry have a look and see if they know what to do with it? If not, let it die.

That ambivalence is present in many of the things one reads. I happen to believe in the first view. I believe that this is an enormously valuable program to the United States, and that emphasis should emerge from any of the current bills. The first requirement is that there should be a continuous program. We have already lost continuity, but we should try to seek it again, and we should make that a very high priority item.

The second thing we should do, if we decide that industry is the right way to do this, is to put as few constraints on industry as possible. It is not reasonable to ask industry to embark on a commercially risky activity, which has also been bound and fettered in as many ways as we can think of, to make sure it satisfies every other national requirement. And again, there is an ambivalence. I feel that people want to have their cake and eat it. They would like a commercially successful program, but they would also like a program which satisfies everyone. I do not think those two are consistent with each other.

Senator GORTON. Thank you.

Dr. Williamson, your technical memorandum touches on more issues than we can possibly discuss today. Are you willing, for the record, to provide us with technical comments on S. 2292 as it relates to the issues?

Dr. WILLIAMSON. Indeed we are, Mr. Chairman.

Senator GORTON. Thank you.

Senator Pressler, we are now called for a rollcall. I will let Senator Pressler start or finish his questioning. And, panel 3, we will be back as soon as the rollcall is over and hear from you.

Senator PRESSLER. Would it be all right if I started my questioning?

Senator GORTON. By all means.

Senator PRESSLER. I will keep going until after the second bell, or as long as I can. If I have to recess I will, and then try to get back as soon as possible. I do apologize for being in and out. I have got my Rural Telephone Co-op people in town today also, so there are various issues we are wrestling with this morning.

I want to thank this panel. I have looked at your statements and heard some of your testimony. I do have a couple of questions here.

I will address this to anyone. What level of technology do you envisage for the following-on satellite to Landsat? For example, in spatial resolution and spectral capabilities?

Dr. WILLIAMSON. We believe that, at a minimum, it should be MSS quality data, not necessarily from that instrument, but at a minimum data of equal quality. We also believe that in order to expand the market into new areas that could not be covered by the MSS data, it will be necessary for a private corporation to develop more advanced sensors.

So we envision both happening, but certainly at a minimum it is crucial to be able to deliver MSS quality data.

Senator **Pressler**. You do not think the Government should go beyond MSS?

Dr. **Williamson**. Well, we have stated in our written testimony that the Government would be well advised to consider a continued research program in advanced sensors. The sort of thing that NASA is now considering is probably too expensive and too risky for the private sector to embark on at this time.

So, certainly, we should continue our research in advanced sensors. I would expect, however, that the private sector would also be very interested in continuing their own advanced sensor development work as well.

Senator **Pressler**. OK.

Dr. **Sheffield**. I would like to make a comment. The multispectral scanner technology is old technology. It is as though we were pinning our aircraft industry hopes on the Lockheed Electra or the Constellation. The MSS has been flying since 1972; it was under development long before that.

We should be looking for technologies that will put the United States in the lead at the turn of the century, not today. And you do not get there with multispectral scanner technology, and you do not get there with thematic mapper technology. You get there by looking at instruments which cut the spectrum up into many more pieces, and which allow many more decisions to be made, controlled from the ground, about what you will acquire as data.

So long as we pin our thinking to something evolved before 1970, I do not see how we can have a long-term, successful program. And by successful, I mean successful to maintain U.S. leadership. Commercialization is one thing; leadership is another thing. If the program does not do both, it fails. And I think any suggestion that we settle for MSS technology would be a big mistake.

We should be looking at the systems we want flying by the mid-1990's. When we look at those, and when we look at the competition from abroad—you have already referenced the French system—80-meter resolution will not do. The French will be flying a 10-meter system by 1985.

For us to look backward for what we will do, is I think a great mistake. We have to look beyond the French system. We have to look for systems that will do more than what SPOT will do; but to look at systems that merely compete with ourselves as we did in 1972 takes us nowhere.

Senator **Pressler**. How far down the resolution should we go? You mentioned the French SPOT going down to 10?

Dr. **Sheffield**. SPOT will go to 10 meters. I believe that the whole resolution question will blow up at some point, because some nation will decide they are going to launch a system with, perhaps, 3-meter resolution, and then we have to sit back and say to ourselves, well, we have a choice; we can either allow a civilian system of our own to be launched with that resolution, or we can allow that new satellite to capture very big markets that could have been ours.

We will have to face that, although we have not had to face it yet. We have had to face 10 meters, and that took a lot of hard swallowing before it was considered an acceptable civilian system.

Senator **Pressler**. Dr. Williamson, what is your reaction to that?

Dr. **Williamson**. I do not think we are in disagreement at all about the need for advanced systems. OTA suggesting simply a minimum, based on the current data sales. Our concern is for the commercial viability. If a system were to immediately supply only thematic mapper quality data of that resolution and those number of spectral bands, the problem that many, many users would then face is to upgrade their system at great cost, and we feel certain that in the near term that would be a great inhibitor to the market.

In the long term, of course, one might expect the data users to be able to reach that capability, but in fact the thematic mapper is not proven at this point in terms of its actual use to many of the users who require those data and the information that those data can provide. Users also need data that are delivered promptly. In some cases, for example, agriculture, prompt delivery is more important than resolution.

Mr. **Spann**. Can I add just a comment?

I basically agree that we are going to see an evolving technology, but I do not really believe that if the Government wants to commercialize the system, that it can dictate the technology to be used. It should allow the commercial operator to determine what the marketplace is willing to pay for.

Senator **Pressler**. But private industry has not indicated they would go down to that resolution. Should this be the continued role of the Government, even with partial commercialization? We do not know if private industry will go down to that level. They have not indicated they would go down to that resolution.

Let's say some other country comes down to a resolution of 3 or 10. What are we going to do? How is it going to happen?

Dr. **Sheffield**. Well, we are under the constraint of doing whatever we are asked to do for national security reasons; and I think that the Defense Department will ultimately be the group that will carry a lead role in deciding what resolution is acceptable.

I think industry would like to have the opportunity for some purposes to collect very high resolution information from space; but at the moment that is not a possibility because it is constrained by other national security questions.

Let me add one other comment. There is a big difference between the data you provide to a final user, the resolution of what you collect from space. They do not have to be the same at all. If you have a very high resolution system in space, the potential exists to return it to the ground, and then deliver processed information at whatever resolution the user wishes.

If you do not have the high resolution system in space, there is no way you will be able to create high resolution from the degraded information you get back. You have got to get it right in space. You must have the resolution there; once you do that, what you deliver to a final user can be anything that the user wishes.

Senator **Pressler**. So maybe we are making the mistake of trying to get on two separate tracks, one commercial and the other one Government. Maybe it could be done in cooperation with the private sector.

What are your reactions to that?

Dr. **Sheffield**. I think the whole program must be a cooperative effort between industry and Government. I do not see how it could work otherwise, because of the public good aspects of the program. They are considerable.

For the Government to throw away its baby, and say to industry, take it away and raise it, does not work. It has to be a cooperative effort in which the Government recognizes the need for technological leadership and cooperates with industry to establish that.

So it has to have both components.

Senator **Pressler**. Dr. Williamson—oh, I am sorry. Go ahead.

Mr. **Spann**. I was just going to echo that. I think cooperation is vital.

Senator **Pressler**. OK.

Dr. Williamson, you mentioned the need for a complete archival facility. Do you think this should remain a Government function, and how up to date should we keep it? Also, could you expound a little more on what you mean by complete?

Dr. **Williamson**. I certainly think that there should be an archival facility maintained. I suspect that at least in the near term, that the private operator would not find it possible to maintain an archive and to do everything else it has to do, without considerable Government help.

So I suspect it would be very useful to retain that within the Government.

What I mean by a complete data set is complete, cloud-free coverage of the entire world. At present, we have no complete set of Landsat images in either MSS or TM for the whole world. Now, partly, that is because in certain areas of the world, almost daily cloud coverage prevents the sensons from seeing the surface. But it would be possible, in time, to develop a complete set of data for every spot over the Earth, so that later, researchers could compare images from a particular place on Earth at an earlier time with current data.

For such critical applications as deforestation, which is a problem for the United States as well as it is for many of the developing countries of the world, and also for desertification—the process of turning good, arable land into desert—that can be monitored by Landsat, a very critical application globally.

Senator **Pressler**. I am going to have to recess this or I will miss a vote. Just stay right where you are. This committee is in suspended recess until one of us gets back.

[Recess.]

Senator **Gorton** [presiding]. Senator Pressler tells me that he had finished with his questions for this panel.

We are ready to go to panel 3, with Dr. Lillesand from the University of Wisconsin and Dr. Henderson from the Geosat Committee.

Dr. Lillesand, you may proceed.

STATEMENTS OF DR. THOMAS M. LILLESAND, PROFESSOR OF REMOTE SENSING, UNIVERSITY OF WISCONSIN-MADISON, ON BEHALF OF THE AMERICAN SOCIETY OF PHOTOGRAMMETRY, ACCOMPANIED BY JOHN M. PALATIELLO, GOVERNMENT AFFAIRS DIRECTOR; AND DR. FREDERICK B. HENDERSON III, PRESIDENT, GEOSAT COMMITTEE, INC.

Dr. LILLESAND. Thank you.

With me today is John Palatiello, who is the government affairs director of the American Society of Photogrammetry.

Before I begin my testimony, I would like to indicate, for the benefit of those of you who are not familiar with our organization, the nature of ASP's membership. That is, our members are 8,000 in terms of numbers; they come from government, industry, education, private practice. They represent disciplines as varied as agriculture, engineering, forestry, to archeology, coastal management, geology, and others.

Our interest in the commercialization issue is not financial, but technical. I would like to say right off that we are indeed very much supportive of the philosophy of the bill. We agree with the RFP process as a mechanism for industry to bring needed innovation to the program, but we do have a number of concerns that we wish to express, many of which are nothing more than echoing the expressions of concern from previous witnesses this morning.

Wearing a unversity hat, as I do, one concern of course, is the general role for a university support that was alluded to earlier by Dr. Williamson of OTA. But transcending those, first of all, is the issue of data quality as perceived by the user.

We have asked specifically in our written statement for report language specifying quality at least similar to the TM. And notice I said "at least." This is an expression from the non-Federal user community that, after 12 years of MSS data, we now need something better at the State, local, private levels of the user community.

We cannot use MSS type data to map the wetlands of the State of Wisconsin. We cannot use MSS data to contribute to our farmland preservation mapping program. We cannot use MSS data to the extent possible by other sensors to contribute to our statewide soil erosion program.

I could go on with what we cannot use MSS for. I must also point out we have used it successfully for limited applications, such as water quality assessment statewide. But the point is, after 12 years of hands on experience at looking at the data, is that we need something better.

Relative to the concept of marketing, it is our opinion that we must be very careful with the perception of what we mean by marketing. Landsat data or any other satellite data are not going to be sold if we simply market the dickens out of them in the context of door-to-door advertising or a Super Bowl ad. We need high-quality data at the right price and with an adaptability of product generation for the user community, and they will sell themselves.

What the Government has not been able to do is to provide to the user community the kind of adaptability to their product needs. In other words, not all users need 7.5 million acres in every scene they buy. But there is a degree of adaptability that, when accommodated, I think without question, the data will sell themselves.

We do not have experience with a TM. When we launched that system, we had the processing capability of two scenes a day. We will increase the price to $4,400 a scene as of next year, and we cannot understand why the data are not selling. I think it is rather clear.

I also think that, again, the value service industry will indeed help market these data, be they provided from a commercial contractor or the Government. Also, we need the best technology up in space that we can get. We do not want that to be the weakest link. As was indicated earlier, we can resample the data on the ground, meet the 80-meter resolution needs that may exist, and yet also meet the more refined needs.

If the data costs go up, we are going to drive State agencies out of the market. Believe me, there is a black market for tapes right now, and if each one of our agencies independently has to buy data, they just are not going to do it at an increased price.

Three alternatives will happen: One, we will go to foreign sources if they are competitive. Two, we will use other forms of information to make decisions; often times it doesn't look so on the front end, but that will cost us more in the last analysis. Or, three, we will make decisions in the absence of the information.

And that is probably the most costly alternative of them all.

Lastly, I must echo the concerns about the scientific value of Landsat data. There was allusion to some of these factors earlier. Let me simply say that I must reinforce the feeling of the scientific community that there are a number of processes ongoing on this planet that are not very well understood. We have heard about desertification. We know about acid rain. We know about other kinds of tropical deforestation, decreased genetic diversity, and so forth.

Landsat represents a public good. We do not seem to have a plan for using it for global resource monitoring over the long pull, nor do we seem to have a plan for defining research needs in remote sensing and interrelating the various programs that are ongoing.

We need a grand scheme, and we have some specific suggestions that we have indicated in our written testimony as to what might be provided under title V within the bill to perhaps sharpen the language with respect to those concerns.

Again, my bottom line here is that we indeed cannot be ambivalent. We have our hands on the most powerful source of information that has ever been known to humankind right now. We have got to figure out what to do with it.

It is a public good. And I am not so sure that we want the market to drive the entire process at this point in time.

Thank you.

[The statement follows:]

STATEMENT OF DR. THOMAS M. LILLESAND, PROFESSOR OF REMOTE SENSING, UNIVERSITY OF WISCONSIN-MADISON ON BEHALF OF THE AMERICAN SOCIETY OF PHOTOGRAMMETRY

Mr. Chairman, members of the subcommittee, thank you for the opportunity to testify today and present the views of the American Society of Photogrammetry (ASP) on S. 2292, the Land Remote Sensing Satellite Act of 1984.

BACKGROUND ON ASP AND ITS INTEREST IN COMMERCIALIZATION

Before presenting the substance of my testimony, I would like to point out that ASP was established in 1934 and is the world's largest professional/scientific society devoted to the exchange of ideas and the dissemination of knowledge and new information about the application of the combined fields of photogrammetry and remote sensing. The society's 8,000 members come from across the spectrum of education, all levels of government, industry, and private practice. Hence, the membership of the society includes technical researchers, remote sensing practitioners, members of the value-added sector, and end-users alike.

One of our organization's principal activities is the publication of scientific literature on the subject of remote sensing such as the *Manual of Remote Sensing* and the monthly journal *Photogrammetric Engineering and Remote Sensing*. These publications are recognized internationally as authoritative sources on the state of the art of remote sensing. Hence, our interest in the commercialization issue as an organization is not financial, but technical.

To highlight the scope of the aforementioned publications and our organization I would like to point out that the *Manual of Remote Sensing* is a document with contributions from over 200 authorities, not only on remote sensing theory and techniques, but on the application of remote sensing data to a host of resource management and environmental monitoring problems. Likewise, ASP's journal is distributed worldwide and contains up-to-date information on the application of remote sensing in fields ranging from agriculture, engineering, forestry, geology, hydrology, and land planning, to archaeology and planetary exploration. In addition, ASP is affiliated with the American Congress on Surveying and Mapping (ACSM), a national professional society with 20,000 national and state members in the fields of surveying, mapping, and geodesy.

The general concerns of our organization about the whole concept of commercialization are a matter of record of various previous fora (including the House hearing of July 21, 1983). The intent of my testimony today is to present only the most salient issues which a broad segment of the remote sensing research, value-added service, and user community deem significant in the discussion of S. 2292.

AGREEMENT WITH THE FUNDAMENTAL PHILOSOPHY OF THE BILL

We are indeed gratified by the fundamental philosophy of this legislation. It recognizes the long-term importance of continuing our global monitoring program, the potential for commercial opportunities therein, and the urgency involved in formulating a clear commitment to the program. At the same time, the legislation attempts to provide a mechanism for determining the extent to which it is appropriate and in the national interest for the private sector to assume responsibility for system operation and data management. We applaud these extremely important elements of the legislation.

While running the risk of oversimplying the whole issue at hand, I think it's safe to assume that all of us believe commercialization is an inherently desirable objective for our civil land remote sensing program. The questions are when do we start, at what rate do we proceed, and what form of commercial involvement insures the greatest service to the national interest. If properly implemented, this legislation would set a framework for obtaining answers to these questions.

LEGISLATIVE CONCERNS

The basic concern we have revolves around whether we are all operating under the same premise in interpreting the legislation. We fear that many participants in the commercialization debate see the problem as solely one dimensional—Landsat is very expensive and it generates little direct revenue. What follows from this perspective is the apparently logical conclusion that all that has to be done to make commercialization a success is decrease the operating cost of the system and increase the data marketing efforts. What must be realized, however, is that all remote sensing data are not created equal; nor is the commercial appeal of the data going to be dramatically improved through door-to-door marketing or prime time advertising. Over the long haul, two very fundamental factors will dictate the economics of our land remote sensing program and its service to the national interest. These are data quality and data cost.

DATA QUALITY

We now have 12 years of experience with Landsat Multispectral Scanner (MSS) technology which indicates that broad segments of the user community require data of much higher quality than that delivered by MSS technology. This is true in terms of the data's spatial resolution, spectal resolution, reliability and timeliness. Preliminary experience with the Landsat Thematic Mapper (TM) suggests that a quantum jump in the number and range of applications of Landsat data are within reach with this more advanced sensor. Note my use of the term "preliminary experience" in that, unfortunately, we are only beginning to learn the information value of TM data. This is due in part to the technical problems experienced with Landsat-4, in part to the inability of the ground processing system to produce data at a rate sufficient for broad user exposure, and in part to the cost of the data.

User experience with TM data, albeit limited, is setting a new standard of acceptability for data. Among other things, the TM data contain much more spatial detail than that afforded by the MSS and they permit the spectral differentation between important resource types with a level of specificity impossible to obtain with MSS data. For the geologist this means improved discrimination of potential petroleum or natural gas sites. For the forester this means being able to discriminate in greater detail the various species types of commercial timber areas and planning economical insect and disease control strategies. For the agriculturalist this means improved ability to inventory crops present in an area and assess their condition. For the cartographer it means publishing image-based maps at a scale never before feasible with space data. For the researcher, it means broad new avenues of both basic and applied research in a host of scientific areas.

The bottom line of the data quality issue is that the size and scope of the potential data market will increase tremendously if the quality of the data provided is significantly improved relative to that currently typified by the MSS products. In this light, we would suggest report language to accompany the bill which would point to the importance of providing data of quality at least functionally similar to that from the TM.

In this regard we are *not* suggesting commitment to another TM system per se. This system by many standards is already technically antiquated. What we do mean to indicate is that a solely market driven selection of a sensor system today might lead to the development of a marginally, rather than radically, improved version of the MSS. While the short-term economics of such a marginally improved system might be attractive, the long-term limitation on the market of such a selection must be avoided. Further, it would appear desirable to provide at least a general degree of continuity in the form of data made available from Landsat 5 and the system(s) operated under Title III of the bill.

DATA COST

At the beginning of the Landsat program, prices for the data reflected only the actual cost of reproduction and dissemination. That is, data prices were set using the same philosophy governing the costs charged users for such items as government maps and aerial photographs. Currently, prices are not set by the cost of data reproduction and dissemination, but rather by the principle of using data sales to recover a greater share of the costs of the entire Landsat system. This shift in philosophy has been a deep concern to ASP for some time and on March 18, 1982 the society's Board of Direction passed and forwarded to this Committee, its House counterpart, and to the President, the following resolution:

"Whereas the American Society of Photogrammetry which represents the collective disciplines of photogrammetry and remote sensing, is aware that the prices for copies of Landsat data were increased in 1981, and are scheduled to be raised again (more than doubled) in October 1982;

Whereas the current prices have already resulted in a significant decrease in the volum of Landsat product sales;

Whereas the full value of Landsat data for current and future government and private applications (including data from the new Landsat D) can only be realized if the data continue to be available at reasonable prices; and

Whereas the October 1982 prices will inhibit all but the most affluent users from purchasing Landsat products, and it will be difficult for the average user to realize the benefits of a promising program for which taxpayers have already contributed about 1 billion dollars.

Now, therefore, be it resolved that the Society recommends that the U.S. Government maintain prices for Landsat data which reflect actual cost of reproduction and dissemination."

Current prices for MSS data in computer tape form indicate that an image costing $200 in 1980, costs $650 today, and will cost $730 in 1985. A tape for one scene of data from Landsat's TM costs $3,400 today and will cost $4,400 in 1985. It is our feeling that this current price structure is severely restricting the data market—particularly for the TM data. *We must emphasize that further increases in data prices would be devastating to certain elements of the user community.*

Obviously, the impact of data costs varies widely among users. For the upper levels of management of petroleum exploration enterprises, the cost of Landsat data is in the "noise" level of the total cost of the exploration process. Believe me, from the point of view of the university researcher and teacher, such costs comprise a substantial proportion of the "signal" of our operations.

In this light we echo the concern expressed in the recently published Technical Memorandum from the Office of Technology Assessment (Remote Sensing and the Private Sector) which states:

"Although the system to produce data from the MSS sensor aboard Landsat 4 is appropriately termed "operational," many of the techniques to use the data effectively are by no means well understood. Thematic mapper (TM) data will require considerable experimentation in order to learn how to make the best possible use of them. The universities could play a strong role in such research. Without a continuing source of data and continued experimentation in the public and private sectors with applying both MSS and TM data, the market for data and data products will not develop and potential benefits will remain unexploited by the United States."

State and local governments represent another segment of users who would be severely impacted by rises in the price of data. In fact, in order to cut the current cost of data many states share Landsat products purchased from the Government with other states. Sharing data by copying data tapes or photographic products is now a common practice not only in state and local government, but also in universities, industry and federal agency.

The value-added industry is another sector of users strongly impacted by data cost. These companies constitute a small, but growing, information/service industry specializing in processing, analyzing and interpreting remote sensing data in a manner aimed at their customers' specific information needs. Because the costs of the raw data are simply passed along to customers, substantial increase in data prices would certainly humper the growth of small value-added companies.

An additional point to be made about the land remote sensing user community is that it contains a relatively small proportion of users who require a "one-time" observation capability. Geologists tend to fall in this category (although not exclusively). Those users in the renewable resource management area—be they federal, state, or private—require timely data on a repetitive basis. This is particularly true in the areas of agriculture and forestry. Likewise, environmental monitoring applications such as water quality or vegetation damage trend analyses require repetitive observation. One-time coverage of Wisconsin with TM data, if it became available in the next year, would cost our state approximately $50,000 under the present pricing schedule. Given the fundamental lack of knowledge and experience with applying TM-type data to problems of statewide significance, an increase in price could totally prohibit the use of Landsat data in areas key to the long-term economy of a state such as ours.

In short, in that the user community is still in its infancy relative to its ability to fully understand and exploit satellite remote sensing data, users will likely respond to any increase in data cost in one of three ways:

(1) They will buy from foreign sources if these sources provide high quality data at reasonable cost;

(2) They will use alternative means (i.e., other than remote sensing) to collect the needed information; or

(3) They simply may not be able to study large scale trends in their resource bases.

The direct and indirect costs resulting from the various mixes of these three alternatives are impossible to quantify at this point, but we know they would be very high.

SCIENTIFIC CONCERNS

As a scientist I tend to shy away from soapboxes and overstatements of the gloom and doom variety. But I must emphasize that my colleagues in the scientific community tell me that the future quality of life on earth is premised on a much more thorough understanding of the global physical and biological processes currently operative. I frankly am in no position to judge personally the long-term consequences of such complex phenomena as global soil erosion, atmospheric and climatic variation, ocean degradation, tropical deforestation, desertification, acid rain, decreased genetic diversity, energy demand, food and fiber supply, and global population distribution. Nor can we foresee the potential political ramifications worldwide, of the stress these problems place on the human environment. What I do know is that satellite remote sensing can play a central role in better understanding all these phenomena if we have the systems and the research capacity to tackle the problem. Again, it is very hard for me to attempt to assign a dollar value to what we might learn in the process.

I find it interesting that at least historically government has had little difficulty deciding—on faith and belief in the ultimate value of science—to make substantial investments in looking at the other planets, but finds it very difficult to bring itself to make even relatively modest investments in looking at the earth. Likewise we sometimes spare no expense to save money. The scientific value of Landsat data must be considered along with their market value in implementing our present decision-making process.

CLARIFICATION OF RESEARCH AND DEVELOPMENT REQUIREMENTS AND MECHANISMS

We are pleased to see attention to research and development under Title V of the bill, but we strongly recommend that the language under Sec. 501 be strengthened in two respects. First, what constitutes an "experimental" program is subject to broad interpretation. We would hope that the intent is to provide for aggressive "long-term exploratory research and development" on the one hand, and "applications demonstration programs" on the other. Secondly, in carrying out such programs we would hope that federal agencies are encouraged to not only cooperate with "private industry," but also with "universities, professional and technical societies, state and local governments, foreign governments, and international organizations."

NEED FOR GLOBAL MONITORING PROGRAM UNIFIED NATIONAL PLAN FOR REMOTE SENSING RESEARCH AND DEVELOPMENT

As alluded to earlier, many processes of which we have only superficial understanding are changing the nature of this planet's land surfaces, oceans, and atmosphere. While remote sensing can play a key role in better understanding and monitoring these phenomena, it doesn't appear to us that we have a national plan for applying remote sensing in the context of a well designed global resource monitoring program on a continuing basis. In this regard, we would hope that the scope of Title V would be enlarged to charge some federal entity (or entities) with the development of a continuing program for global monitoring, and the formulation of a unified national plan for remote sensing research to support the program. This plan should result in a means of informing the Congress, on a regular basis, relative to: (1) the status of, and interrelationship between, on-going remote sensing research and development programs; (2) the state of our knowledge about the earth's lands, oceans and atmosphere as enhanced through space remote sensing observations; and (3) the needs for additional research to support both the global observation program and the various federal operational remote sensing programs.

Here again, we feel it is totally inappropriate for ASP to recommend to the Congress how these initiatives might be accomplished. We simply wish to emphasize their need and importance.

CONCLUSION

ASP fully supports the philosophy of the bill and commends its authors for their vision in developing a framework for a phased approach to commercialization while setting forth conditions under which any transition is acceptable to the Congress. We are pleased to see the due regard in the bill for our international commitments, our national security, the open skies policy, the concept of continuity, the need for enhanced research and development, the provision for a global environmental archive, and the potential for creative commercial opportunities in the land remote sensing program.

Furthermore, ASP fully supports the ongoing RFP process in terms of its creating a mechanism for industry to bring needed innovation into the program. Our only recommendation is that Congress make it clear to those who might be implementing this legislation that great discretion must be exercised in choosing among the various data quality and pricing options which will be proposed. These will determine the long-term value and vitality of our program. In this regard, we are not suggesting that Congress at this point dictate technology or establish prices. We simply look to Congress to insure that these facets of any potential commercial operation serve the national interest to the fullest extent possible. Thus, our earlier request for report language to emphasize this point.

We are also suggesting the need to establish a clear, unified national research and development agenda, and to develop a continuing program for global resource monitoring.

With the Age of Information upon us, remote sensing holds the potential to play an increasingly important role in providing for the improved peaceful and bountiful habitability of Earth. The long-term global implications of the choices made now on the form and conduct of our civil remote sensing programs are indeed profound. Right now our Government holds the lead in acquiring and sharing one of the most fundamental forms of information ever available to humankind—the status of natural resources on a global basis. The World has patiently awaited for several years our decision on what we are going to do with this capability, but this patience is wearing thin.

Be it on a commercial, government or combined basis, we must move forward with a clear plan for providing uninterrupted acquisition, distribution and archiving of global remote sensing data in a timely manner, on a non-discriminatory basis, and at equitable prices. Further delays will be devastating to our program.

[The following information was subsequently received for the record:]

Questions of the Minority and the Answers Thereto

Question. With regard to the issue of data quality, you indicate that a "solely market driven selection of a sensor system today might lead to the development of a marginally, rather than radically, improved version of the MSS."

Would this problem be remedied if the "quality and quantity" of data were established as evaluation criteria in place of the MSS baseline?

Answer. Again, we believe it would be undesirable for the FRP of the supporting legislation to dictate a specific design configuration. The critical point to stress is that whereas many federal needs might be met with MSS technology, many will not. Likewise, members of the non-federal user community have needs which can only be met with a sensor having at least "TM-similar" capability. Also, a data acquisition *and* processing capability of at least 100 scenes a day would be desirable. Specification of design parameters beyond this is difficult at this juncture because of insufficient experience with the TM. For example, we don't yet know the importance of the particular visible, infrared, and thermal bands present on the TM. We would hope that improvements to the TM design would typify our operational system and that the scientific integrity of any commercial system would weigh heavily in the evaluation process. It is not clear to us how these scientific concerns are being accommodated.

Question. Could a U.S. commercial venture with a marginally improved MSS sensor system compete with the French SPOT satellite?

Answer. Given competitive data prices, a marginally improved MSS sensor system could feasibly compete with the French Spot Satellite for the "moderate resolution market niche." The problem with this scenario is that the U.S. demand for high resolution data would only then be satisfied by SPOT. As data processing technology continues to accelerate, the demand for this high resolution data will likewise accelerate. Again, from a scientific and long-range economic standpoint it would appear that we would want a radically improved sensor which could meet *both* the high and moderate resolution data needs. (The data from a properly designed high resolution system can be aggregated to meet the needs of MSS users, but the reverse is not possible).

Question. How elastic is the user demand for Landsat data to price increases? Can commercial system expand the data market to the point where significant data price increases will not be required?

Answer. The user demand for Landsat data is very elastic relative to price increases for the overwhelming majority of the market. As mentioned in our written testimony, however, there are certain segments of the user market whose demand is relatively inelastic relative to price. In this regard, we feel it is extremely important that data prices result in the greatest public good being served by the system. Thus, prices must be low enough to permit the development of a broadly—based market.

Question. The ASP represents members of the value-added sector, Value-added services will play an important role in the commercialization of remote sensing.

Answer. Yes, a commercial system could feasibly expand the data market to the point where significant price increases would not be required, but only if the appropriate technology is reliably available; applications research is greatly accelerated to broaden the market, and graduated government support for the operation is available in order to compete in the world market over the long-term. Earmarking a small fraction of data sales receipts for both basic and applied research might be highly desirable in this light.

Question. In the opinion of the membership of ASP, are the safeguards contained in Title II of S. 2292 concerning the provision of value-added services adequate?

If antitrust laws are applicable, should there be any prohibition on the sale of value-added products to the Federal government?

Answer. I personally am not qualified to speak with specificity on the adequacy of the provisions of Title II and the anti-trust laws relative to safeguarding the value-added service industry. Several of the Sustaining Members of ASP are active in this industry and we would be glad to refer these questions to some of them if you so desire. Earth Satellite Corporation is one such firm we might recommend that you consult on these matters.

Senator GORTON. Thank you, Doctor.

Doctor Henderson.

Dr. HENDERSON. Thank you, Senator.

I apologize for my voice, having a good California cold. I appreciate the opportunity of being here to testify on behalf of the Geosat Committee which represents roughly 100 energy, mineral, and engineering companies who use Landsat remote sensing primarily for geological applications on a global basis.

I appreciate the opportunity to talk on commercialization of the civil land remote sensing systems and the potential impact on this country's dependence on global resources for strategic energy and mineral resources, a point that has not been brought up so far this morning.

Civil land remote sensing satellites have proven they can provide useful information about the geology of the Earth and assist us in better understanding the global distribution of energy and mineral resources. Because a strong U.S economy will always depend on access to such global resources, it is in the national interest to assure that civil land remote sensing systems be continually evolving through a commitment by the U.S. Government.

The Geosat Committee believes that the eventual commercialization of part or all of the civil land remote sensing systems is in the eventual best interests of the continuing development of these technologies, but we are concerned about the possible prematurity of commercialization at this time.

As the largest group of sophisticated industrial end users of Landsat data, we really do not care who owns it, who operates it, who develops these systems. What we do deeply care about is that a strong civil land remote sensing program be maintained in the United States and that it continue to provide us with the kind of data that we need with which to compete worldwide for energy and mineral resources for the United States, her allies, and her trading partners.

We strongly advocate the continuity of data, the concept of which has been spoken of this morning, and of the cooperation between the Government and the private sector to create a strong and continuously evolving civil land remote sensing program in the United States.

We, some 80 companies strong which are processing Landsat data, do not share the commitment to the multispectral scanner [MSS] as the baseline. We strongly support the thematic mapper [TM] as the basic technological baseline at this time.

I concur with Charles Sheffield's comments, that we need to look beyond the TM in the future, and, as a baseline, we should not go back to the MSS system. That would be foolish.

Because OMB appears to adamantly oppose continuing the Landsat system beyond Landsat 5, the Geosat Committee urges Congress to take leadership in protecting the U.S. program and providing continuity of data until such time as realistic commercial systems can evolve. In this context, the Geosat Committee supports in principle S. 2292 and its call for phased transition from Government to the private sector, based on the necessary Government financial support to assure such a transition.

However, "phased" is not the key word; the key words are to continue Government support until a market can be developed by whomever is selected, or whether the Government maintains the system if it is not commercial.

We urge you to support and maintain a strong, continuously evolving U.S. civil remote sensing program with regards to continued high-risk or exploratory R&D in the area of satellite of remote sensing and applications.

The Geosat Committee strongly supports the position expressed in your legislation regarding the "Open Skies" policy and nondiscriminatory access to unenhanced data. International cooperation in the development of complementary and compatible civil land remote sensing satellite systems and ground receiving stations is paramount to the sensible development of global civil systems.

If, for whatever reason, principal satellite producing countries should turn away from the "Open Skies" policy, then the world risks an expensive, proliferating, "intelligence resource arms race" which will develop nationalistic remote sensing satellites to compete for world resources.

We also strongly encourage the development of the value-added industry and whatever the bill can write in to encourage its development. It must be competitive and open to multilevel use of this data, and no single company can really do that.

In my testimony, I have included a "cartoon" which was also included in my testimony before the House last fall. I would like to emphasize that we have a short time in which to get your bill, the House bill, and the administrative process together before we go into an election year which could lose perhaps 2 or 3 years before making a decision and create an additional several-year data gap for the Landsat program.

I encourage what you are doing and support the effort of your bill.

Finally, as one last statement, I would like to emphasize that our concern about Landsat remote sensing is related to global access to this country's required base resources, as well as the rest of the free world, and we should not lose sight of that in the commercialization process.

Thank you.

[The statement follows:]

Statement of Dr. Frederick B. Henderson III, President Geosat Committee, Inc.

Mr. Chairman, I am pleased and appreciative of the opportunity to testify before the Subcommittee on behalf of The Geosat Committee, on the issues related to the commercialization of civil land remote sensing systems and its potential impact on this country's growing dependence on global sources for strategic energy and mineral resources. Civil land satellites have proven over the past decade that they can provide useful information about the geology of this earth and assist in a better understanding of the global distribution of energy and mineral resources. Because a strong United States economy will always depend on access to such global resources, it is in the national interest to assure that civil land remote sensing systems are maintained, protected and caused to continually evolve through a commitment by the United States Government. Whereas commercialization may ultimately be the vehicle to obtain the optimum efficiency and usefulness of this technology, the United States Government must remain committed to assuring a strong United States Civil Land Remote Sensing program in its own self interest.

THE GEOSAT COMMITTEE

The Geosat Committee, Inc., is sponsored by approximately 100 U.S. and non-U.S. international oil, gas, mineral and engineering geological companies who produce more than half of this nation's non-renewable energy and mineral resources. This Committee is a unique industrial initiative to present to all pertinent U.S. and non-U.S. governmental entities the considered professional geological recommendations of the nation's largest single industrial group of users of satellite imaging data, a role which should continue to expand significantly. Since 1976, The Geosat Committee has worked diligently with various branches of NASA, the United States Geological Survey, France's C.N.E.S., Japan's NASDA and others in order to determine what supplemental remote sensing systems including Landsat would optimize the combined systems for geological remote sensing from space.

At our Board meeting in Orlando, Florida on February 2, 1984, the Board of Directors and members in attendance reviewed the recent developments regarding the commercialization of civil land remote sensing, both in the Administration and in Congress. In my testimony today I shall try to incorporate the current thinking of The Geosat Committee on the issue and on the impact of commercialization. The Geosat Committee strongly supports the recent positions taken by the Civil Operational Remote Sensing Satellite Advisory Committee (CORSSAC, previously LRSSAC) appointed by Secretary of Commerce Malcolm Baldrige and chaired by Michel T. Halbouty.

THE COMMERCIALIZATION OF CIVIL LAND REMOTE SENSING

Whereas the Geosat Committee believes that the eventual commercialization of part or all of civil land remote sensing systems is in the eventual best interest of the continuing development of these technologies we are very concerned that a premature effort to commercialize could in fact jeopardize or even cause their demise within the United States. While supporting commercialization in the long term, we, as the largest group of sophisticated industrial end users of the Landsat data don't really care who owns, operates, or develops these systems. What we do care deeply about is that a strong civil land remote sensing program be maintained in the United States and that it will continuously provide us with the right kind of data we need to compete worldwide for energy and mineral resources needed by the United States, her allies, and trading partners over the next few decades.

Commercialization is supported by The Geosat Committee if the process can provide the geological community with the data needed to compete internationally for required non-renewable and renewable resources. If it cannot, then the responsibility to continue such a system resides in the government. Commercialization should not occur for commercialization's sake alone nor to help balance the annual OMB/Congress budgetary debate for remote sensing satellites. It should not be a part of U.S. military/civil technical and budget priorities.

In order to maintain such a strong U.S. program, we will have to operate on a cooperative basis between the private sector and government as our international competitors have learned to do. The current debate over commercialization has tended to polarize the interests of the government versus those of the private sector. We believe this is a wrong. Rather, The Geosat Committee believes that the commercialization process should be a means to an end; namely that of providing cooperation between the government and the private sector to create a strong and continuously evolving civil land remote sensing program in the United States.

In order to accomplish this goal, I should like to address several issues raised in your draft legislation specifically and in the current debate on commercialization in general.

CONTINUITY OF DATA

The Geosat Committee believes that the continuity of a strong and continuously evolving civil land remote sensing program is of vital importance to the United States. We believe that this is true whether this program resides in the government, the private sector, or both.

We do not share the commitment that the ongoing programs must maintain a multi-spectral scanner (MSS) base line. We would prefer to see the program evolve as the technology evolves. From the point of view of many of the more sophisticated Geosat users, the MSS is both antiquated and redundant with respect to the thematic mapper (TM). Basic MSS-type data can be produced on board the spacecraft from the TM system. We therefore believe the U.S. base line should be the TM. Accordingly, The Board of Directors of The Geosat Committee unanimously voted at its February 2, 1984 meeting in Orlando, Florida to support the recommendations of the January 26–27, 1984 Halbouty CORSSAC meeting for a base line of TM-like data:

"In the light of non-Federal user requirements for global data of higher spectral and spatial resolutions than the Multi-spectral System (MSS), because no U.S. commercial satellite system will succeed unless it provides data commercially competitive in the world marketplace, and in view of the fact that higher resolution data can be resampled to meet MSS user requirements, the Government must insure that there is no interruption in acquisition, distribution, and archiving of, at a minimum, "Thematic mapper-like" (TM-like) [1] data. In this regard, whether commercialization is achieved or not, it is vital to the national interest that "TM-like" data be continuously acquired until better systems are developed.

Our basic goal for the 1980's is to acquire at least a one-time global data set of TM data and to maintain continual TM-type data programs for the near future. If this requires one or more Landsat/TM satellite systems, then we would support further Landsat/TM satellite development. We applaud the Administration and Congressional actions to move up Landsat D' (5) to a March 1984 launch data to replace the unfortunately ailing Landsat 4.

In order to fulfill our goal of at least one TM global data set, and in agreement with this Administration's original decision to allow two Landsat D/TM systems to develop the required market for commercialization, The Geosat Committee strongly supports the July 29, 1983 Halbouty CORSSAC recommendation to push forward now for the early lead items for Landsat D" and an early government commitment to fly Landsat 6. This appears to be the only way to avoid a TM Landsat 3-year data gap built into the Request for Proposal (RFP). This 3-year data gap would in our opinion be disastrous to the development of an on-going civil land remote sensing program in the U.S. Furthermore, it would ensure our dependence on non-U.S. data sources, if available, and would stifle for many years to come the currently stalled upgrade and development of foreign ground receiving station capabilities to acquire, archive, and distribute Landsat TM data around the world.

Because the OMB appears to adamantly oppose continuing the Landsat/TM program beyond Landsat-5, The Geosat Committee urges Congress to take the leadership in protecting the U.S. program and providing continuity of data until such time as a realistically commercial system can evolve. In this context, The Geosat Committee supports in principle S. 2292 in its call for a phased transition from the government to the private sector based upon necessary government financial support to assure such a transition during the requisite private sector market development. Phased commercialization, with early ground segment development and follow-on value-added industry development, are of paramount importance in order to develop a viable, multi-level, value-added service industry which helps create a viable land observational satellite remote sensing system.

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[1] Currently, "TM-like" data are data acquired synoptically over swaths greater than 100km; data acquired in a sun-synchronous manner with illumination conditions similar to those of Landsat; data acquired with 3 bands in the visible, 3 bands in the reflected infrared, and one band in the thermal infrared; data required at a resolution of 30 meters in all but the thermal band and 120 meters in the thermal band. Bandpasses, radiometric sensitivity, geometric fidelity, etc., to be within a few percent of the characteristics of the present TM system."

Government must recognize its responsibility for fiscal support during the transition phase, which, like most other government-industry transfers in the past, requires several years. Government's R&D expenses to date would be a wasted expense for the taxpayer if the transition from a government to a private sector responsibility led to a decision to terminate the U.S. civil land observation satellite remote sensing systems which was based on commerciality only. The United States government, dependent on global access to non-renewable resources for many years to come, must support a U.S. land remote sensing satellite whether it is or is not commercial.

The preamble to S. 2292 states it is "a bill to provide for continuous access by the Federal Government to land remote sensing data from satellites and for other purposes; to the Committee on Commerce, Science, and Transportation." If this bill is to provide for continued access by the Federal Government to non-military, i.e., civil, land remote sensing, then the government must assure a government-private sector transition, or, failing commercialization, a continued government civil land observation remote sensing satellite system. This is properly the responsibility of the U.S. Federal Government.

FUTURE RESEARCH AND DEVELOPMENT

In order to maintain a strong, continously evolving U.S. civil land remote sensing program, the United States government must revitalize and commit to continued high-risk, exploratory sensor and applications research and development. Historically this type of R&D can best be done only be the government. In the case of civil land remote sensing, this is particularly true of the past accomplishments of NASA.

Without such continued R&D, it will not be possible to design future civil land remote sensing systems capable of maintaining U.S. leadership of even parity with the burgeoning remote sensing technologies developing outside the United States. Remote sensing examples are many. Several years ago, I testified a number of times before your Space Committee regarding the need to develop a high spatial resolution, Landsat-compatible digital stereoscopic satellite called STEREOSAT. Because of the inability of the Administration, the House, the Senate, and the private sector to agree on who was being served and who should pay for such a system, as Americans, we all lost. As a result, a French-led European built system will fly a better system known as SPOT. Similarly, because of recent decisions of the U.S. government not to cooperate on some joint space developments, under the auspices of protecting U.S. technology transfer, the Japanese will build in Japan probably the best synthetic aperture radar yet for their JERS-1 satellite in 1990. Also, the Germans have commissioned an in-house development of solid state sensors for their Moms project which may fly before comparable U.S. sensors on a commercial basis.

If the U.S. is committed to the continuity of civil land remote sensing, then the government must take the lead in providing high risk exploratory R&D for sensors and applications. Military R&D in this area will not trickle down fast enough for the civil community to complete internationally. Private sector R&D is generally not high-risk exploratory R&D leading to new systems. In addition, it is usually proprietary and goal oriented in a non-commerical mode. It is in the national interest for the public goods for the government to maintain future R&D programs to maintain ongoing, and continuously evolving, internationally competitive civil land remote sensing systems in the United States.

OPEN SKIES POLICY

The Geosat Committee supports the position expressed in your draft legislation regarding "Open Skies" policy. We believe the U.S. and the rest of the world have benefitted enormously from the "Open Skies" policy set forth and maintained by the United States for over the last two decades.

As international explorers for global energy and mineral resources, global data and information derived therefrom are vital to the success of our efforts. International cooperation on the exchange of civil land remote sensing data appears, except from the Soviet Union point of view, to be the only logical economic path to follow. International cooperation on the development of complementary and compatible civil land remote sensing satellite systems and ground receiving stations is paramount to the sensible development of global civil systems. If, for whatever reason, the prinicipal satellite producing countries should turn away from the "Open Skies" policy, then the world risks an expensive, proliferating "intelligence arms race" to develop nationalistic remote sensing satellite systems to further compete for world resources. It is our belief that maintance of the "Open Skies" policy of open, internationally cooperating systems is the only way of assuring that land remote sensing satellite systems will remain in the international civil community in the best interest of all.

The alternative of restricted, proprietary civil commercial systems would tend to encourage U.S. military encroachment in the U.S. civil satellite remote sensing systems, restrict access to civil satellite remote sensing systems, and significantly decrease the access to data acquired by French, Japanese, and other systems under competitive international resources exploration efforts.

The Geosat Committee believes that there is no inherent incompatibility of the "Open Skies" policy based on non-discriminatory access to data. Under any realistic commerical proposal made to data, proprietary rights to data under current international copyright laws is required to protect the commercial entity's investment. While not lawyers, it is our understanding, through various legal standards of "group shoot" type of data purchase and non-exclusive data sharing that both the concepts of "Open Skies" policy and reasonable commercial control of data especially information derived therefrom can be mutually satisfied under international contract law.

THE VALUE-ADDED INDUSTRY AND COMMERCIAL MARKET DEVELOPMENT

Closely related to the "Open Skies" issue of non-discriminatory access to data, is our mutual concern of protecting the development of the value-added industry and its role in creating the real market necessary to commercialize the civil land remote sensing.

As indicated in the submitted value-added industry paper, we generally believe that without the development of a strong international value-added industry to serve the many levels of user requirements, that a true market sufficient to commercialize a Landsat-type program will not materialize in sufficient time to compete with other developing international systems. The Geosat Committee generally believes that it is the value-added industry which clearly can expand and become commercial now. This is especially true if the government is removed from the data handling process. It is even more true if the government would attempt to state its real data requirements as opposed to its unreal position in the RFP process that the U.S. government has no Landsat requirements. While that position may satisfy OMB, it does not assist in any meaningful effort to commercialize.

The Geosat Committee supports the Halbouty CORSSAC position that the value-added industry is best protected by making non-discriminatory access to the government and/or private sector data stream at the "raw data" format. We agree with your proposed legislation on this point of access to "unenhanced" data. We also strongly believe that this type of data or perhaps selected computer compatible tapes (CCTs) derived therefrom should be archived in a government-supported National Archive which should allow access to such "unclassified" data in accordance with non-discriminatory, equitable and timely access principles stated elsewhere in your draft legislation.

Commercial entities in the value-added industry obviously should retain proprietary rights to the downstream value-added data and information derived from the "raw data." The Geosat Committee is mixed on whether a selected owner-operator of the satellite system should be allowed to compete in the value-added industry. However it would probably be generally acceptable if stringent "raw data" non-discriminatory access was guaranteed by legislation such as yours so that no undue advantage accrued to the data stream owner-operator.

Commercialization of the ground segment value-added industry has begun and is clearly the first viable segment to transfer to the private sector as part of a phased transition commercialization of civil and remote sensing. We believe that a market-driven strong value-added industry capable of providing multi-level products to a multi-level use community is a paramount requirement to the eventual successful commercialization of the civil land remote sensing program in the United States.

LANDSAT AND ORWELL'S 1984

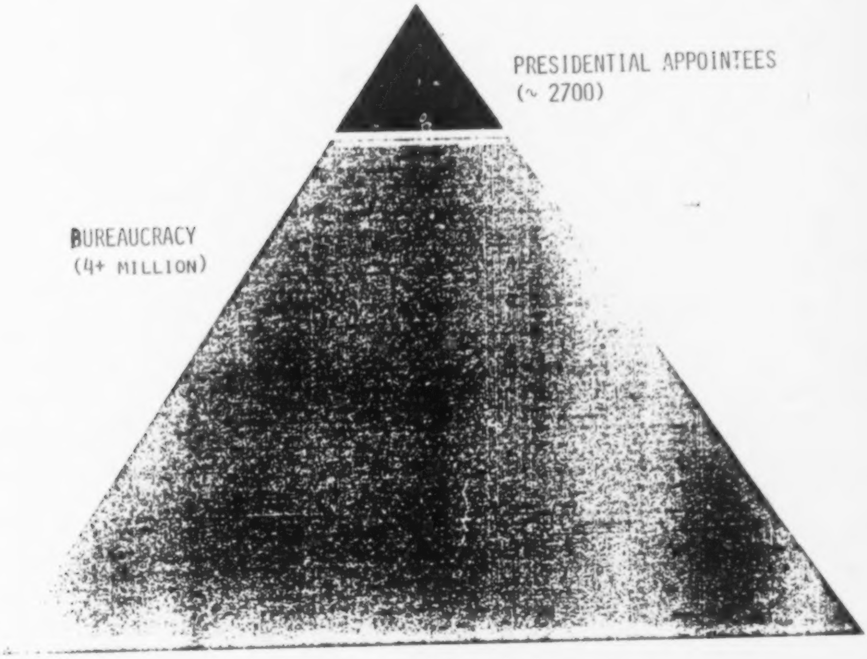
Figures 1 and 2 are simplistic cartoons prepared for lay businessmen interested in commercialization. Figure 1 indicates my explanation of how our government works; a large bureaucracy capped off by a relatively few but forever changing group of political appointees at the top. While the significance of these changes at the top is debatable, their change particularly affect the U.S. government decision potential (DP) as shown in Figure 2. This cartoon expresses our 8-year experience of the potential for a government decision and implementation in the field of civil land remote sensing. The peak of the Carter Administration was the announcement of P.D. 54 to privatize the Landsat program guaranteeing four Landsat/TM satellites for the 1980's which would provide 10 plus years coverage to allow for privatization (commercialization). Subsequently an 18-month low of DP occurred during the 1980 election year and 1981 adjustment to a new Administration and Congress. The Reagan Administration, beginning with the 1981(2) budget decision to lop off Landsat D" and D"', began its uphill DP course leading to the current RFP process intended originally to result in a May 1984 decision on commercialization.

The Geosat Committee is extremely concerned that, given the current uncertainties of the RFP process for Landsat, the continuity of the Landsat civil land remote sensing program could be severely damaged as we go into the politics of the 1984 election year, as indicated by the dashed line of Figure 2. We are encouraged by the apparent converging of Senate Bill 2922, House Bill 4836, and the thrust of the Source Evaluation Board's RFP requirements. The Geosat Committee strongly urges your committee to work closely with the House Committee on Science and Technology to merge your bills, bring them to a positive vote and allow enabling legislation to be passed which will cooperate with the Administration so that a commercialization decision one way or the other can be made this year. The United States must proceed with a continuing land observation satellite program in the private or government sector in the best interests of its citizens.

LANDSAT AND U.S. NON-RENEWABLE RESOURCES

In spite of the best intentions of the last four Administrations, it is imperative that the U.S. government recognize that to maintain its world leadership in science and technology and in its economic and military strength, it will always require access to global non-renewable resources, whether directly by exploration and exploitation or through world trade. Access to such global resources (non-renewable as well as renewable) is in the national interest of the United States and to the rest of the world economy. Information sources such as Landsat data will become more important as more countries develop these technologies. The United States government must recognize its responsibilities to provide for a continuing land observation satellite program whether or not it is commercially viable.

U. S. GOVERNMENT ADMINISTRATION



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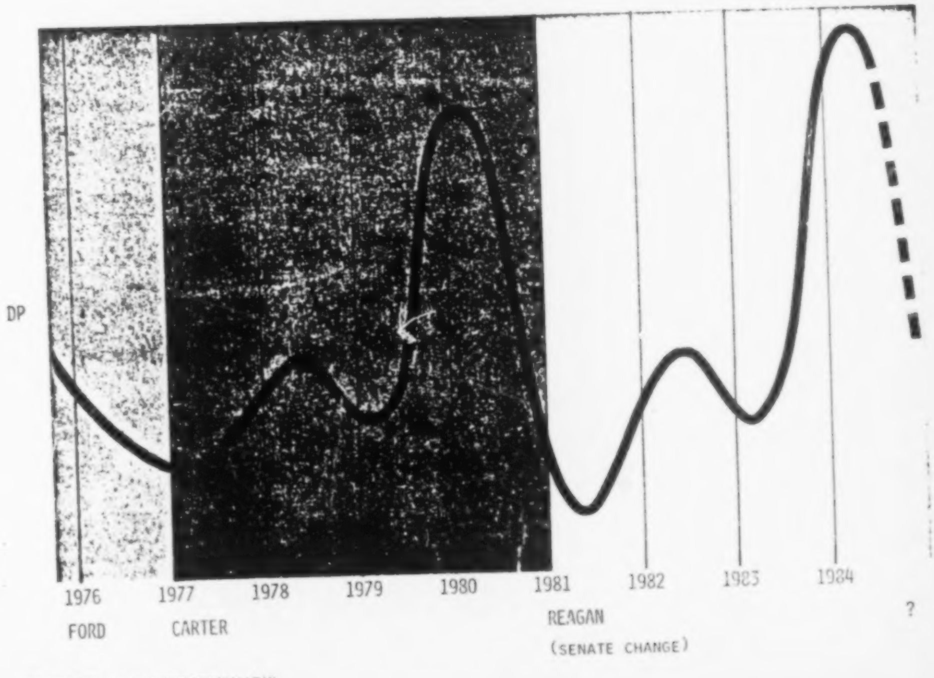
U. S. GOVERNMENT DECISION POTENTIAL (DP)
(GEOSAT EXPERIENCE)



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Senator GORTON. Both of you recommend that the followon to Landsat 5 should be equipped with the thematic mapper. Do you think data users are willing to pay enough for the thematic mapper data to recover the costs of that capability?

Dr. LILLESAND. I guess maybe first I will respond to that, from the standpoint that our expression is that data available be at least equivalent to the thematic mapper. We are not specifying the thematic mapper per se, because that is already an antiquated system.

My answer to this is that the impact on the user community varies dramatically with who it is. I suspect for the members of upper management of the kind of firms that Dr. Henderson represents, the cost of those data are in the noise level of the exploration process.

Believe me, as a university researcher, they are in the middle of the signal. So that is a very difficult question to answer.

I suspect, given the current technical immaturity of State and local organizations, that they would not be prepared at this juncture to pay—and they are not paying the current costs for TM data.

Dr. HENDERSON. The companies that I do represent, some 80 that are doing in-house digital data processing around the world—not all U.S. companies, they include other companies and other countries' organizations in geology—do want TM as a basic data set and a global data set is a minimum. But I think it should be made clear that again we are not calling for a continuous TM system as currently exists on Landsat 5. We are calling for selectable bands at reasonably high resolution, 10-, 20-, 30- meter resolution, in the visible, very near infrared, and the short wave infrared. That is the new part of the TM that is extremely exciting and extremely important in our community and will be also useful to the agriculture and timber communities as we begin to learn the anomalies of what we are seeing in that kind of technology.

What we are saying is that a TM baseline is really the capability of having bands in the short wave infrared as well as the visible and very near infrared of the MSS system.

And, yes, we will be willing to pay for it.

Senator GORTON. We have heard testimony to the effect that a true commercial system should be market driven rather than technology driven. The two of you apparently disagree with that statement.

If generation of only multispectral scanner data would leave the market for higher resolution data to foreign systems, and if that market is a large one, won't natural market forces induce American system operators to produce higher quality data?

Dr. HENDERSON. In my opinion, of course, the owner-operator or operators—because I agree with somebody else's statement this morning that there was going to be more than one business here eventually—will certainly fill up the gap for all different levels of the requirements; for resolution, for spectral response, for stereo, for radar, et cetera.

I do not think that will happen all in one system overnight, though. But I would say, generally speaking, yes, the market will eventually develop.

But again, I would like to emphasize, let us not forget the Government responsibility concerning fundamental information for resources for the needs of our economy.

Dr. LILLESAND. One of the other provisions, as I understand it, under title III, that is of unknown duration at this point, is the contractual obligation to a firm to provide a certain level of data. It is entirely feasible, I suspect, that a firm could indeed market data of coarse resolution that would meet the needs, for example, of developing countries quite adequately and be a commercially viable enterprise.

The problem is that that does not a national remote sensing program make. It defines the American niche. And I do not think that we want the American niche at this point to be defined that narrowly, nor with that degree of technical antiquity. I think we want to work on the other end. We want to sell and develop new cars, not sell the used ones.

Senator GORTON. If S. 2292 were to become law, do you feel that quality of data should be the main consideration in evaluating proposals for development of a follow-on system, or do you think factors like cost and ability to develop the market are equally important?

Dr. HENDERSON. Again, I have to repeat myself and say that I think in that consideration, we must take into account what this information provides in the national interest of the United States.

If it is going to be a commercial system, then obviously the cost and the profits and so on and so forth will be the driving factor. I hope in your deliberations in the bill and also in the administration's deliberations, in looking at the proposed owner-operator bids that we do not lose count of the national interests of this kind of information in competing for worldwide resources.

Dr. LILLESAND. My response: In light of the given foreign competition, in light of the scientific need for the data, as I alluded to earlier, I must say though we have MSS as "our operational system," MSS was declared operational. That does not mean that we have 50 States out there that know how to use the data on a day-to-day basis.

We do not have a great deal of experience with the TM. Let me say that again. But in light of the needs as we see it from the scientific community, and the potential for what remotely sensed data can supply, both domestically and around this globe, perhaps we do have to have our cake and eat it, too, at this time, in light of foreign competition.

Senator GORTON. What will be the consequences of a congressional failure to make any decision on Landsat commercialization this year?

Dr. HENDERSON. Based on 8 years of trying to figure out why we have not done this before, I would say that it would seriously represent an additional 2- or 3-year data gap, based on going into an election year in which decisions will not be made, if you do not do it now. So it is very exciting to see your bill, the House bill, and the administration that close together. I hope you come together by May.

Dr. LILLESAND. Just to echo that, be it governmental, commercial, or combined, the important thing is to get the job done now.

Senator GORTON. Thank you both very much.

The meeting is adjourned.

[Whereupon, at 12:20 p.m., the hearing was adjourned.]

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